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THE
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THE COPPER ESKIMOS*

By DIAMOND JENNESS
Ethnologist, Canadian Arctic Expedition

The so-called Central or Copper Eskimos live in part on the northern fringe of the mainland coast of North America in the Coronation Gulf region and in part on the great land mass known as Victoria Island, which lies directly north. The region over which they migrate extends from Stapylton Bay on the west to and beyond Kent Peninsula on the east (Fig. 1). During the two years from September, 1914, to July, 1916, I lived in their winter settlements, which are distributed all the way from Dolphin and Union Strait to Bathurst Inlet, and in that time I spent seven months—April to November, 1915—wandering alone with them in the southwestern part of Victoria Island. The following account of their life and its relation to their Arctic home is based on my experiences during that time and on information obtained from other members of the Canadian Arctic Expedition.

It will help our understanding of their customs, and particularly their migrations and trade, if we glance for a moment at their geographical distribution. They live in five groups, each of which again has its minor subdivisions, as follows:

(1) Those who winter in Prince Albert Sound and in the vicinity of Minto Inlet on Victoria Island. The former are known as Kanghiryuarmiut and have been estimated by Stefansson to number about two hundred;[1] the latter, Kanghiryuatjagmiut, are stated by the same authority to consist of three families only, and number therefore about fourteen or fifteen. In the winter of 1915-16, however, many Kanghiryuarmiut joined their northern neighbors, so that the two settlements were about evenly divided.

* In 1916 Mr. Jenness made a report to the Canadian government on his work among the Copper Eskimos. The report is dated July 18, *H. M. S. Alaska*, Young Point, North West Territories. It is published here for the first time, and with appropriate alterations, by courtesy of the Commissioner of the North-West Mounted Police at Regina.

[1] For an account of the discovery of this tribe see V. Stefansson's "My Life with the Eskimo," New York, 1913, p. 279.

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(2) Those who congregate in Dolphin and Union Strait in winter, around Liston and Sutton Islands. Generally they number about one hundred, and are composed of the sub-groups Akulliakattungmiut from Stapylton and South Bays, Noahognirmiut from the large triangular wedge of land that apexes at Cape Krusenstern, and Puivlirmiut from the opposite

FIG. 1—Sketch-map of the Coronation Gulf region, on the northern edge of continental North America, showing the location of Eskimo tribes. Scale, 1:5,000,000.

shore of Victoria Island. Hannerak, the Eskimo name for the southwest corner of Victoria Island,[2] is only occasionally occupied by the Eskimos in summer, and the Hanneragmiut have ceased to form a separate subdivision of the Copper Eskimos.

(3) Eskimos from the Rae and Coppermine River basins, who gather

[2] For the Eskimo names of geographical features in this region, see the map accompanying V. Stefansson: Victoria Island and the Surrounding Seas, *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 93-106.

in winter at the west end of Coronation Gulf and are composed of Pallirmiut from Rae River, Kogluktomiut from the Coppermine, Asiagmiut from the country between the Coppermine and Tree Rivers, and Nagyuktomiut from the opposite side of the strait. They are often called collectively Walliarmiut, from Walliak, the Eskimo name of Richardson River. Their number, like that of all the groups in this region, varies from year to year but may be stated approximately at one hundred.

(4) East Coronation Gulf Eskimos, comprising Tree River natives (Pingangnaktomiut), Nenitagmiut from the country behind Gray Bay, Kilusiktomiut from Arctic Sound, Umingmaktomiut from the east side of Bathurst Inlet, and Kiglingilmiut from the coast of Victoria Island opposite. A few families live inland south of Bathurst Inlet, in the country called Saningaiyok, but they rarely come to the coast. The more western natives often refer to this eastern group as Kivalirmiut, or the eastern people. Their number is approximately one hundred and fifty.

(5) Dease Strait natives, consisting of Asiagmiut[3] from the country east of Kent Peninsula, and Ekalluktomiut from the southeastern extremity of Victoria Island. Very little is known about these Eskimos, but the natives of the eastern part of Coronation Gulf, with whom they have regular communication, estimate them at about one hundred.

These groups are permanent, but the families who compose them continually change from one to another, so that the location of a man at any particular time is uncertain. As a rule it is to a neighboring group that he attaches himself for a season or two, but occasionally to one more remote. Contact takes place between the different groups mainly in the spring, and it is then that their composition undergoes a change. There is brisk trading, too, in pots, lamps, weapons, skins, and other household furnishings. The desire to trade often impels them to make extensive journeys. From eastern Coronation Gulf they connect with the Nechillingmiut Eskimos of Back's River[4] and with the natives on the Arkillinirk, or Thelon River,[5] both of whom have direct relations with white traders. Since 1911 the Coronation Gulf natives have visited Great Bear Lake each year to trade with whites and Indians. Half a century ago the Dolphin and Union Strait Eskimos used to meet others that went eastward one hundred to one hundred and fifty miles from Cape Parry and Cape Bathurst to the vicinity of Wise Point, but since white men have established themselves in the Mackenzie Delta and since whaling ships have paid regular visits to Herschel and Baillie Islands, respectively at its western and its eastern portal, broadly speaking, the Copper Eskimos have lost touch with their western neighbors. In 1905, however, C. Klongenberg in the *Olga*, and in 1907 C. Mogg, in another vessel of the same name, wintered on the south-

[3] Just off the right margin of the map in 102° W.

[4] Flows east-northeastward some 150 to 200 miles inland from the longitude of Bathurst Inlet to that of Elliot Bay (96° W.), where it debouches.

[5] Some 75 to 100 miles south of Back's River.

FIG. 2—Spring camp of the Copper Eskimos at Bernard Harbor, Dolphin and Union Strait, June, 1916. Women pegging out deerskins to dry. (Figs. 2-11 are from photos by the author, published by courtesy of the Geological Survey of Canada.)

FIG. 3—Eskimos spearing salmon as they migrate up the streams. June, 1916.

west coast of Victoria Island; both had western Eskimos among their crews and both met the local natives for a short period. Stefansson met them in 1910 and again in company with Dr. R. M. Anderson in 1911, on both occasions accompanied by western Eskimos. In 1910, J. Bernard entered the country and spent a winter; in 1912 he returned and spent two additional winters, having with him an Eskimo family from Baillie Island. From 1914 to 1916 the Canadian Arctic Expedition was in uninterrupted contact with the same natives, while the northern party of the same expedition met the Eskimos of Prince Albert Sound and Minto Inlet. The Anglican Church has sent missionaries into the country, who have now probably established themselves in Dolphin and Union Strait. Traders and western Eskimos are reported to be following in their wake, so that the Copper-Eskimos will again have constant relations with the west, and with the whites as well as with the old trading groups they have been accustomed to meet in years past.

The language of the Copper Eskimos, so far as we now know, is practically uniform. Its nearest relations seem to be with the Mackenzie dialect rather than with that of Hudson Bay, but natives from either place should make satisfactory interpreters. A Mackenzie native would probably get on better with the western Copper Eskimos and a Hudson Bay native with the eastern, but neither would have any serious difficulty anywhere.

Established authority among the Copper Eskimos is unknown. By virtue of their personal dignity, their force of character, skill in hunting, or reputation for magical power, certain men are more influential than others but possess no constituted authority over a group or tribe. The only law is custom, handed down from generation to generation; it alone upholds the structure of society, maintains the taboos, and regulates the relation of family to family and of man to man. Its sanction is religion, and violation of custom is punished, through spiritual powers, by sickness and death, or ill-success in hunting and fishing. The magic of the shamans is, for the most part, devoted to neutralizing or securing the active support of the innumerable spirits that are believed to control the phenomena of nature and the supply of game. Misfortune and death are occasionally ascribed to evil magic, but any man suspected of sorcery is liable to sudden murderous attack from his fellow-tribesmen.

Speaking generally, all food is shared in common, but weapons, tools, and household furnishings are private property. The greatest check on theft is the extreme intimacy of social relations, everyone being aware of what is said, done, or owned by all the rest. Nevertheless a little pilfering does occur, even among themselves; and, in the absence of any established authority, the victim's only redress is by an appeal to physical force, which, with a people whose emotions, like those of children, have not come under the control of a developed temperament, frequently means murder. The

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 4—A Coronation Gulf Eskimo woman named Paylik, wife of the man shown in Figure 5. April, 1916.

FIG. 5—A Coronation Gulf Eskimo man named Aitauk. Originally he lived at Asiak, east of Kent Peninsula. April, 1916.

FIG. 6—Boy bringing in fuel, consisting of *hawyak*, the dry leaves of the *Dryas octopetala*. Southwestern Victoria Island. July, 1914.

FIG. 7—Tokalluak, a Coronation Gulf Eskimo man. June, 1916.

FIG. 8.

FIG. 9.

FIG. 8—Eskimo settlement of snow huts in the Duke of York Archipelago, Coronation Gulf, March, 1915.
FIG. 9—Copper Eskimos migrating, April, 1915.

most trifling incident may lead to this result. In 1914 a man stabbed another merely to prove that the knife his victim ridiculed was a good one. The murderer in turn is sometimes slain by the kinsmen of his victim and a vendetta is established, but in most cases this outcome is avoided by his flight to another district, when his deed, after the lapse of a few years, passes into oblivion.

Family organization is, in its general features, very similar to our own. Interchange of wives, however, is common, polygamy frequent, and polyandry not unknown. Girls occasionally marry before they attain the age of puberty, but rarely have children before the age of sixteen or seventeen years. The death-rate is high and the mortality among children especially heavy. Infanticide is frequent; four cases occurred in Dolphin and Union Strait in the winter of 1915-16. One of twins is always killed; the girl, if the sexes are different. Usually the child is suffocated before it is exposed. On the other hand, abortion is unknown. The chief reason for infanticide seems to be that the bringing up of a child entails severe hardship on the mother; not only must she nurse it for several years until it is able to endure the strong meat and fish diet which constitutes the only food, but must carry it everywhere on her back, in addition to a heavy pack, through all their migratory summer life. The child is spared, however, if someone can be found to adopt it, and adoption is frequent. The aged and infirm are not abandoned, as is the case among some Eskimo tribes, but receive the utmost kindness and consideration.

The food supply is practically limited to seals, fish, and caribou. Polar bears, brown bears, musk-oxen, squirrels, and one or two minor animals supplement these articles a little in some places, but never become staples. Seal skins and caribou skins are indispensable for clothing and tents, and seal blubber for fuel and light. The natives take kindly to the white man's food, but only as a luxury. Sealing is prosecuted in winter, when the seals are harpooned through their breathing holes in the ice. At this season the Eskimos are gathered in large settlements off the coast. In spring they migrate to the land, scattering into small bands to fish in the streams and lakes and hunt the caribou which are then making their way northward. For fishing spears and lines are used, usually with barbless hooks; salmon are trapped in stone weirs and speared as they migrate up the streams to the lakes. Caribou are shot with the bow and arrow, or speared from kayaks when driven into lakes. Recently a number of Winchester rifles have been introduced, mostly of 30-30 and .44 caliber. In consequence more caribou are shot than formerly, and the natives are learning to shoot seals on the surface of the ice in spring. Rifles may in years to come seriously reduce the number of caribou in the country, and more valuable than they would be the introduction of fish-nets, for almost every lake teems with salmon and trout, and the salmon annually migrate in large numbers up most of the rivers and creeks. The possession of umiaks, too, if the art of

FIG. 10.

FIG. 11.

FIG. 10—Jiggling for trout through six feet of ice in the spring (May, 1915). Colville Hills, southwestern Victoria Island.

FIG. 11—Building a snow hut, Okauyarvik Creek, southwestern Victoria Island, October, 1915.

making them were learned from the western natives, would greatly assist in the setting of nets as well as in the shooting of seals in the open sea.

Since the visit of J. Bernard, the Eskimos are devoting considerable time to the trapping of foxes. These are probably less numerous than farther west, but still there are enough to make the industry profitable. Traps are in great demand on this account. Every kind of cloth, too, is eagerly sought after. Woolen clothing would be very serviceable during the greater part of the year and cloth tents invaluable in summer; but woolen and cotton garments of any description are likely to introduce pulmonary troubles among a people ignorant of their proper use. At present these people are very healthy and without any serious ailments. The population appears to be about stationary, owing to a low birth-rate and a high death-rate, the result of the hardships of life in the Arctic. But if ever the diseases which have swept through the western Eskimos find their way into this country, more especially measles, tuberculosis, and venereal diseases, half the population would probably be swept away within a decade or two. The two latter diseases, if once introduced, would be ineradicable; they would be handed down from one generation to the next, as in the Mackenzie Delta at the present day. Possibly their introduction is inevitable, but since Herschel Island is the chief portal leading into the country at the present time, there would seem to be some prospect of successfully keeping them out if no one, white or native, were allowed to sail from that port eastward to Coronation Gulf without a medical certificate from the medical officer resident in the Delta; anyone found in the country of the Copper Eskimos without such a certificate could be made liable to immediate deportation.

There is the further question as to what use could be made of the Copper Eskimos in the future development of the country. At the present time the only asset which the country possesses is its fur. These Eskimos should be as successful trappers as any in the North, once they have learned the value of the different kinds and qualities of fur. It is not improbable that the copper deposits in the region may eventually prove of great value, but little can be expected from a purely hunting people in the way of labor for mines. Nevertheless it might be possible to utilize them in other ways, as in the handling of freight and in transport generally.

THE PROPOSED CONNECTION OF THE RUSSIAN AND INDIAN RAILWAY SYSTEMS*

By HENRY D. BAKER
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The plan to connect the railway systems of Russia with those of British India is one that has appealed strongly to the imagination, on account of the commercial advantages that would be gained and the immense saving of time that would be made in traveling between western Europe and India, the richest asset of the British Empire. Hitherto, however, there have been objections on the part of the British Government, which preferred that India should be kept separate from the Russian Empire and the other nations of Europe that might make use of such through railway system for purposes of military invasion. Now, however, the new entente and friendship with Russia may remove political obstacles that stand in the way of connecting the Indian and Russian railway systems.

There has been no railway progress in any part of the Russian Empire so rapid during the past year as the extension of the Bokhara Railway south to the Oxus River, also known as the Amu-Daria, and eastward along the north bank of this river, which forms the boundary between Russian Turkestan and Afghanistan, to the present terminus at Termez (Fig. 2). This is only about 550 miles from Peshawar, on the Indian side of the famous Khyber Pass, by which Alexander the Great invaded India and which has subsequently been always considered, both in a military and commercial sense, as the gateway to that country. A few more months of construction of the Bokhara Railway eastward to Sarai, above the junction of the Kundus and Oxus Rivers, the immediate new goal of this system, will leave a gap of only about 400 miles between the railway system of the Russian Empire and that of British India. Whether or not the system would be extended through this remaining gap will depend on the attitude of the British Government and on the consummation of some arrangement with the Amir of Afghanistan for the laying down of such a line through the northeastern corner of His Majesty's hermit country. It is believed that the extension through Afghanistan could very likely be carried out by a separate

* See also the writer's report on "Railway Development in Russian Central Asia," *Commerce Repts.*, April 9, 1917, pp. 103-109, and the passages devoted to the railways and trade routes of India (pp. 73-80), Baluchistan (pp. 475-477), and Afghanistan (pp. 541-544) in the writer's "British India," *Spec. Consular Rept. No. 72*, Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, 1915 (reviewed below under "Geographical Publications").—EDIT. NOTE.

company controlled by Russian and British capitalists, with the Amir himself receiving a large proportion of the stock.

The construction of railways in Russian Turkestan has been steadily proceeding for some years past. First the Central Asiatic Railway, from Krasnovodsk on the east coast of the Caspian Sea to Tashkent in Turkestan, was constructed, with a branch to Kushka, only about 100 miles from Herat in Afghanistan. Then, in the year 1905, Tashkent was connected at Orenburg in southeastern Russia near the Urals with the railway system of European Russia. Finally, dating from July, 1915, the Bokhara Railway, starting from the station Kagan, near the city of Bokhara, on the Central Asiatic Railway, has been extended southward to the Oxus River opposite Afghanistan, and eastward to Termez, the present terminus.

In order to make the last link in the connection of the Russian and Indian railway systems, it will be necessary to cross from the basin of the Oxus to the basin of the Indus; between these two basins the mountain range of the Hindu-Kush presents a barrier which would require considerable engineering skill to overcome. The word "Hindu-Kush" means "Dead Hindu." This name has been given to the range from one of its passes, on which an entire tribe of Hindus perished in an attempt to descend into Turkestan. This mountain range of eternal snows has an extent of 400 miles, with but two passes lower than 12,000 feet; Khawak, 11,640 feet; and Bamian, 11,770 feet. Several of the passes reach an altitude of 19,000 feet, and certain peaks attain 24,000 feet. The adjoining region of the Pamir is indeed often appropriately referred to as the "Roof of the World." Three of the largest empires of the world, the Russian, the British Indian, and the Chinese, as well as the very secluded and comparatively unknown nation of Afghanistan, meet near this point.

The engineering problem of constructing a railway through the Hindu-Kush Mountains from Turkestan to India, will, in the opinion of Russian engineers who have made surveys over this part of the route, find a comparatively easy solution by the boring of a tunnel under the divide separating the headwaters of the Kundus River, flowing towards the Oxus River and Turkestan, from the headwaters of the Kabul River, flowing eastward to the Indus, which drains all of northwestern India. Such a tunnel would, it is estimated, be about 13 miles long, and require excavating through granite rock. Except for the 13 miles of tunnel, the railway construction would be comparatively easy, as it would follow the valley of the Kundus on one side of the divide and the valley of the Kabul on the other side. The average cost per mile of the railway, including the tunnel construction, would, it is estimated, be about $100,000; that is, from the mouth of the Kundus to Peshawar in India, a distance of about 400 miles, the total cost would be about $40,000,000.

In the event of the construction of this railway through the Hindu-Kush the distance between western Europe, starting from the Hook of Holland,

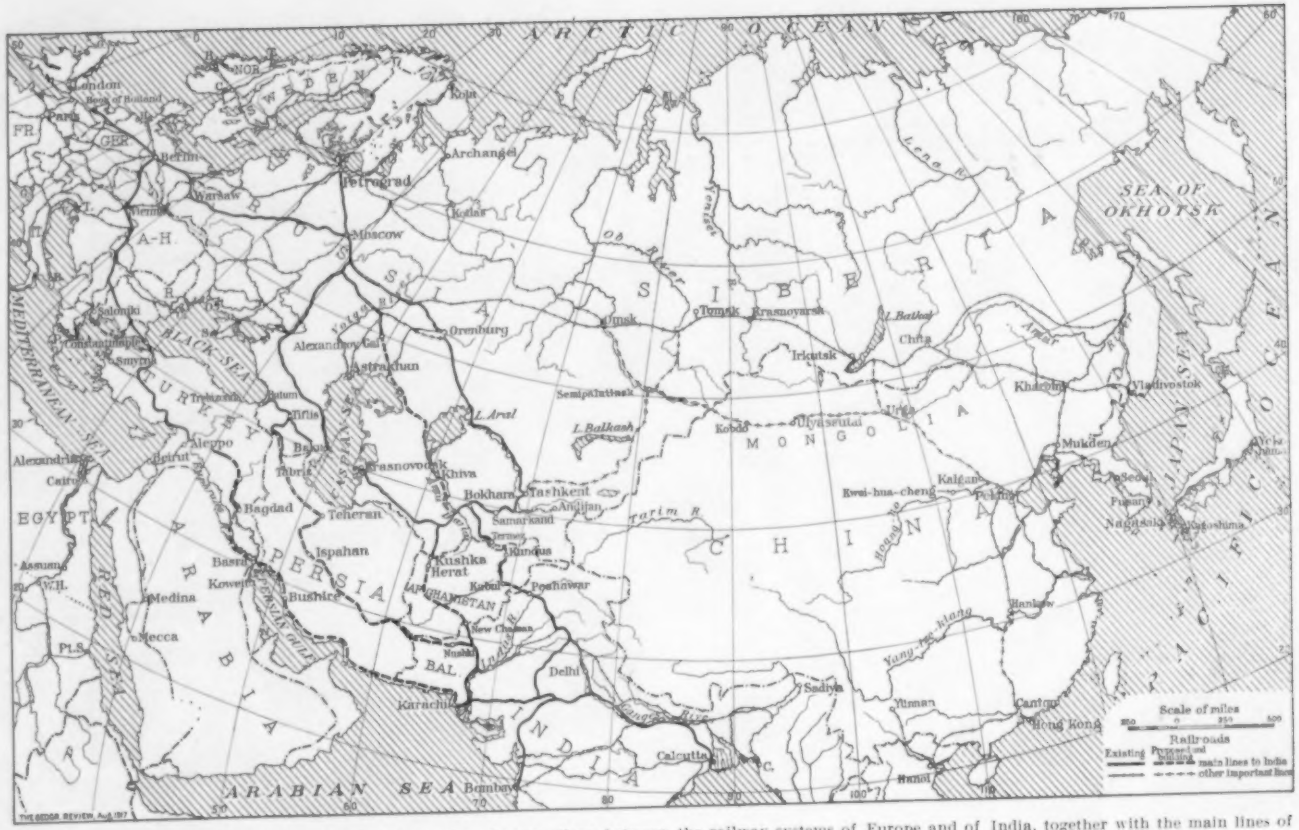

FIG. 1—Outline map of Eurasia showing the proposed connections between the railway systems of Europe and of India, together with the main lines of eastern Asia. Scale, 1:57,000,000.

reached by fast steamer from England, to the Indian capital at Delhi, would be as follows (see Fig. 1):

Hook of Holland-Berlin-Warsaw-Moscow	1,836	miles
Moscow-Orenburg-Tashkent	2,082	"
Tashkent-Kagan-Mouth of Kundus River	750	"
Mouth of Kundus River-Peshawar	400	"
Peshawar-Delhi	627	"
Total (in English miles)	5,695	miles

It may be mentioned that a new railway into Russian Turkestan is now under consideration, via Alexandrov Gai in southeastern Russia and skirting the northeastern shore of the Caspian Sea to Khiva and Bokhara. This railway, if constructed, would make a saving in distance of over 800 miles in the proposed route between Russia and India via the Hindu-Kush.

The Bokhara Railway is owned by Russian capitalists, who have enjoyed special support from the Russian Government and from the Emir of Bokhara, through whose territories the railway has thus far been chiefly operated. It is understood that the Emir of Bokhara has received a bonus of one-third the entire stock of the railway system, but in return he has not only provided the right of way but has also given to the system large tracts of land which would require only a comparatively small expenditure for irrigation from the Oxus River to become one of the finest cotton-growing regions in the world. Interests in control of the Bokhara Railway are giving their attention not only to railway building but also to the development of the country by irrigation and the establishment of industries along the route. Not only do they desire a connection with British India, but they are also already making surveys for possible extension northeast toward the rich gold-mining districts of Mongolia, and for possible connection with the Trans-Siberian Railway at some point in central Siberia.

The great commercial advantages which would result from a connection of the railways of British India with those of Europe must be readily apparent. Although the Indian railway systems are completely isolated from those of other countries, yet they make an average net annual profit of about 7 per cent on their capital. Altogether they have an extent of about 35,000 miles, and much new railway building is planned for the future. If these railways were united with those of Europe, they might take care of an immense through traffic which now of necessity goes by sea via the Suez Canal. Furthermore there should be a great trade developed between Russia and India; for instance, Russia is an immense consumer and India is an immense producer of tea.

The great progress of Russian Turkestan in cotton-growing has excited special attention during the present war, for Russia, owing to the difficulties of securing sufficient cotton from America, through the closing of Baltic Sea ports and the Dardanelles, has been relying more and more on the production in Turkestan, which is increasing heavily each year. Experts in the

Russian cotton trade believe that within ten years Turkestan will produce all the cotton Russia needs, so that no more need be imported from America. There is an extensive movement now for the construction of mills for making cottonseed oil; and it is probable that many textile mills will be erected within the near future, so that Central Asia can produce its own piece goods. In India a beginning has been made in the use of cottonseed oil as a substitute for *ghee*, the native liquified butter which is the chief fat food of millions of her people. It is probable that the immense amount of cottonseed oil which might be produced in Turkestan could be marketed to advantage not only locally but also in British India, if there were railway connections. The proposed railway connection via the Hindu-Kush would also tap Afghanistan, which is a great sheep and fruit country and a large consumer of cotton piece goods, hardware, etc. At present the entire foreign business of Afghanistan goes by caravan routes, the most important via the Khyber Pass. The heavy cost of transportation has so far made the trade of Afghanistan comparatively limited.

A railway connection between India and Europe, say through the Hindu-Kush, would make possible a fast mail service between London and Delhi in six days instead of seventeen days, as at present via the Suez Canal. The cost of the passenger trip by railroad to India would probably be only about half as great as by the present roundabout steamship service. To reduce the time of travel between England and India to one-third of what it is now would prove of incalculable advantage in many ways, and this result would be achieved by the completion of such connections as have been described above.

There is at present in Russia a great awakening to the necessity of expansion in the country's railway facilities, not only to remedy military weaknesses as shown by the war, but also to take advantage of the immense commercial resources of the vast areas of her territory, which, if opened up by adequate railway systems, would experience marvelous development. Not only in Russian Turkestan, but in Persia and Mongolia, important plans have been formed for railway construction to extend the commercial outposts of the Russian Empire.

In addition to the route between Turkestan and India through the Hindu-Kush Mountains, there are also other possible routes to connect India with Europe: (1) by way of Turkey, Persia, and Baluchistan; (2) by way of the Caucasus district of Russia, Persia, and Baluchistan; and (3) by way of Afghanistan, by a line running from Kushka to Herat and then on to Kandahar, only about 80 miles distant from New Chaman in Baluchistan, which is the terminus in Baluchistan of the British Indian railway system.

Until the outbreak of the present war, the two routes by way of Persia had been looked on by the British authorities with more favor than the two possible routes through Russian Turkestan. Of the two Trans-Persian

routes, the first might join the Bagdad Railway from Constantinople at Bagdad, and follow the Euphrates River south to the Persian Gulf at Basra, thence eastward through Bushire and along the southern coast of

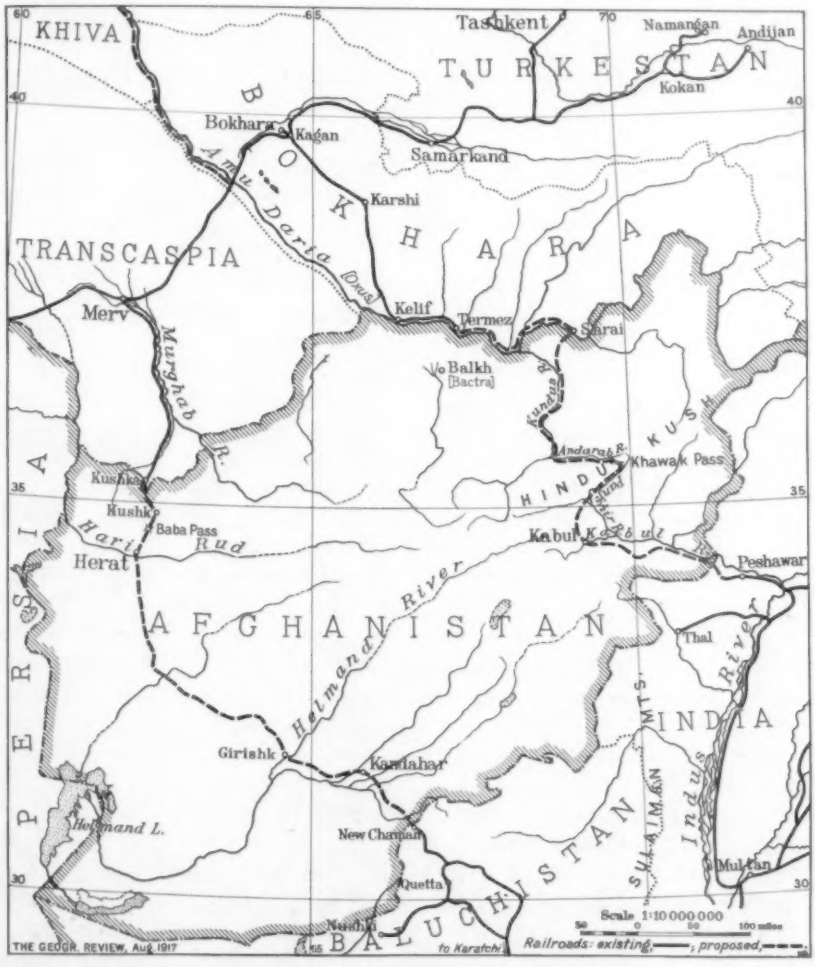

FIG. 2—Outline map showing in greater detail the proposed connections between the Russian and the Indian railway systems through Afghanistan. Scale, 1:10,000,000.

Baluchistan to Karachi, the great grain and cotton exporting port near the mouth of the Indus in northwestern India. The second system might extend from Tiflis in Trans-Caucasia, through Tabriz, Kazvin, Teheran, and Ispahan in Persia to Nushki in Baluchistan, where it would join the British Indian railways. Any proposed connection with the Bagdad Railway

would be dependent upon the outcome of the present war, but even if the present war is entirely successful from the standpoint of the Allies, nevertheless there might, from a British standpoint, be a doubt as to the advisability of making a railway connection which might be of more benefit to Germany than to England. There might, on the other hand, be a disposition to encourage construction which would link the Indian with the Russian system by way of the Caucasus railway. It may be mentioned in this connection that a Russian railway from the Araxes River at the frontier of Trans-Caucasia to Tabriz in northwestern Persia was completed[1] in March, 1916, a distance of about 150 miles. The writer was a passenger on the first train that entered the city of Tabriz. There was great excitement in that city when the train arrived, the locomotives being gaily decorated with Russian and Persian flags. This is the first railway in Persia. It is of the same gauge as the Russian railways, so that there is no reason why trains cannot now be run all the way from Petrograd to Tabriz. At present the line is used chiefly for military purposes, but later it will be used for commerce. This line may eventually be pushed on to Teheran, and perhaps later follow the line of the Indo-European telegraph system toward the sphere of British influence in southern Persia, and it would then rest with the British Government whether or not the Baluchistan railway should be extended to southern Persia to meet it. Through central and southern Persia, however, and through western Baluchistan, it would be necessary to traverse a vast tract of country of a desert-like character with little opportunity for profitable business except on through freights from India to Europe. There is no doubt, however, that from the Caucasus district, at least as far as Teheran, such a railway, traversing the richest part of Persia, would be of great local commercial importance and make an outlet for a large Persian trade now conducted under circumstances of considerable delay and difficulty. Before the war most of the trade of Tabriz with the outside world was by caravan route via Trebizond in Asia Minor on the Black Sea.

The proposed route across Afghanistan by way of Kushka, Herat, Kandahar, and New Chaman would be only 475 miles in length. New Chaman in Baluchistan is close to the boundary of Afghanistan. This town is the most westerly railway outpost of the Northwestern Railway of British India and was built rather for military than commercial purposes. It belongs to the government of India. There is in New Chaman a supply of railway equipment adequate to the immediate construction of a line as far as Kandahar, in the event of any disturbance of political relations with Afghanistan. Several years ago the writer was in Baluchistan and traveled on the railway to New Chaman. The railway traverses the country inhabited by nomadic tribes previously considered barbarous. Although the

[1] See report by the writer on "Opening of the First Railway in Persia." *Commerce Repts.*, April 28, 1916, pp. 372-373 (abstracted in the *Geogr. Rev.*, Vol. 2, p. 156).—EDIT. NOTE.

line is always guarded by a few troops, yet such protection is becoming less and less necessary, and it has been noteworthy that the railways have had a civilizing effect on the inhabitants, who, instead of pursuing the life of bandits and robbing and often murdering travelers as hitherto, now employ themselves in farming and other peaceful pursuits. A great deal of fruit from Afghanistan, chiefly melons and grapes, is shipped over this railway to the larger cities of British India, but, owing to the difficulty in transportation in Afghanistan, the fruit is often spoiled before it can get to the railway in Baluchistan.

Taking the Hook of Holland and Delhi as end points, the various proposed routes compare as follows as to distance:

via Berlin-Vienna-Constantinople-Bagdad-Basra-Bushire-Karachi	5,745 miles
via Moscow-Baku-Tiflis-Tabriz-Teheran-Ispahan-Nushki	5,550 "
via Moscow-Alexandrov Gai-Khiva-Bokhara-Termez-Kabul-Peshawar	4,918 "
via Moscow-Orenburg-Tashkent-Bokhara-Kushka-Kandahar-New Chaman	5,295 "

Besides the fact that the route through the Hindu-Kush appears the shortest, it would be superior to all the others at the present time from a topographical point of view. It would lie between the immense valley of the Ganges and the Indus on the east and low-lying Europe on the west, having only one great ascent, namely through the Hindu-Kush. For the remainder of the distance it would pass along the plains of India and Turkestan and through the level part of Europe. The routes through Persia and through Turkey would meet entirely different conditions. Here it would be necessary to cut through many ranges of hills, a work which would increase not only the first cost of the railway, but also its operating expense, owing to the considerable grades to be overcome. In addition to this, great difficulties would be encountered, both in construction and maintenance, in the desert regions with their ceaselessly drifting sands, a menace to the roadbeds for hundreds of miles. The other route from Delhi, to New Chaman, Kandahar, Herat, and Kushka, would present more difficult positions than the route through the Hindu-Kush. On its course there would be two mountain passes of considerable height, at Herat and at Kushka.

The way through the Hindu-Kush presents also great advantages over other routes with respect to water supply. Along this entire route rivers flow with abundance of water, which not only would meet the needs of the railway but would be a source of energy for hydro-electric stations. Such stations would facilitate the construction of tunnels and provide electrical traction on the hilly part of the route from the junction of the Andarab with the Kundus, as far as the junction of the Gharband with the Pianjsher. Both proposed routes through Persia contrast unfavorably with this as regards available water supply, as they pass through waterless deserts. The northern Persian route would traverse a vast salt desert, while the southern would go through sterile and almost uninhabited country just north of the Persian Gulf. Because of such topographical difficulties

the cost of construction per mile of a Trans-Persian railway would in no way prove less expensive than one through the Hindu-Kush. The northern Trans-Persian railway would probably cost at least $170,000,000, and the southern probably somewhat more. The Kushka-Herat-Kandahar-New Chaman route would probably cost somewhat less than the route through the Hindu-Kush but might have offsetting disadvantages, owing to the great fanatical opposition of the Afghans to the presence of Europeans. In this country it is even a capital offense to embrace the Christian religion.

It is doubtful if the British Government will in the future feel the necessity of keeping Afghanistan undeveloped and uncivilized, merely for the purpose of providing a buffer state between Russia and India. With the exception of Tibet, Afghanistan is at present the least known country in the world and is a barrier to commercial intercourse between the world's two greatest empires. In the same way that the new conditions arising from the war have little by little removed the special political objections to a tunnel under the English Channel between England and France, so also political opposition to connecting the British and Russian railway systems seems likely to disappear. From a strategical standpoint a railway through the Hindu-Kush, with its proposed tunnel 13 miles in length, would seem easy to defend in case of war. The Hindu-Kush mountain chain would be impassable during the greater part of the year, except for the tunnel, which could be readily closed in case of war.

The idea of constructing an Indo-European railway system was first seriously proposed in the year 1873, when the famous engineer, Ferdinand de Lesseps, wrote a letter to Count Ignatieff, the Russian Ambassador at Constantinople, which contained the following words:

> In my opinion the construction of a quick means of communication between the West and the Far East through Central Asia will, in an extraordinary degree, increase the facilities of commerce by the sea routes.
>
> I foresee that the realization of this great project, for whatever reasons it be undertaken, will cause Anglo-Russian antagonism to vanish, an antagonism which has been provoked by the position of affairs in the countries of Central Asia. Indeed, twenty years ago, I foresaw similarly that the construction of the Suez Canal would result in the disappearance of antagonism between France and England, an antagonism which had existed from the beginning of the present century on account of the Egyptian question.
>
> As soon as Central Asiatic territory has been intersected by railways, it will no longer act as a hindrance to the spread of European civilization. The ground for mutual distrust between the rival empires of Russia and England will disappear, a distrust which always assumes a marked character as soon as one of these empires tries with armed force to restore order, when it has been broken on these frontiers by semi-barbaric tribes.

The route of the Indo-European railway proposed by De Lesseps was from Orenburg via Samarkand to Peshawar, there to form a junction with the Indian railways. On receiving the full support of Ignatieff, authorized by the Russian Government, De Lesseps set out for Paris. He devoted himself to organizing an expedition for the purpose of surveying the proposed route. The expedition which he had organized went to India, but, on

account of the opposition of the English authorities, was obliged to return from that country without setting to work.

The first indication that the British Government favored the construction of a railway connecting Europe with India appeared in a speech of Sir Edward Grey in the House of Commons on July 11, 1912, when he said:

> From the Government's point of view, it would be unwise to oppose the construction of a railway, which in any case, sooner or later, must be built. On the contrary, in order to safeguard our own interests, England is bound unremittingly to take part in the construction of the Trans-Persian line.

It will be noticed from this speech that Sir Edward Grey endorsed the proposal for a Trans-Persian railway. In view of the imperiled position of British influence in Persia and the fact that Turkey is now an ally of Germany, it is perhaps likely that the British Foreign Office would oppose a Trans-Persian railway to India, unless the outcome of the present war should remove all doubts as to whether such a railway would subserve British interests instead of those of the Central Powers. Had such a railway been in existence when the war started it would have facilitated a German-Turkish invasion of India by way of Baluchistan. On the other hand, a railway through the Hindu-Kush would have facilitated the co-operation of India and Russia in the present war.

Mongolia also is likely to be an objective for Russian railway extension and in the future the network of Central Asian railways will probably be connected in the west with Europe and in the south with India. Not only is it likely that the Bokhara railway system will be extended toward Mongolia as well as to India, but it seems also probable that a railway will be built from the Trans-Siberian line to Urga, the capital of Mongolia, whence a line might then be constructed across the Gobi Desert to Kwei-hua-cheng, from which place a line is now being completed to Kalgan to join the Peking-Kalgan railway. Then a branch line may be thrown out west from Urga to Ulyassutai, Kobdo, and Semipalatinsk, which would connect eventually with the Samarkand-Bokhara district railway system. When all this is accomplished Peking would be brought four days nearer to London, and Mongolia would be well under the civilizing influences of western Europe. The wealth of its rich northern portion would be developed, and its fertile valleys put under the plough and form another granary for the world. With the Russian railway systems linked with India's by the proposed extension through the Hindu-Kush, India would then have the opportunity of railway communication, roundabout, to be sure, not only with Mongolia, but also with China, should the railway be built across the Gobi Desert.

In 1914 two agreements were drawn up between Russia and Mongolia, one authorizing a concession to the Russian Central Postal and Telegraph Department to construct a telegraph line into Mongolia, and the other allowing for a co-operation between Russia and Mongolia for the construc-

tion of railways to serve the two countries. The agreement stipulates that, although the Mongolian Government shall have the right to construct a useful railroad with its own means, nevertheless, "as regards the granting of railroad concessions to anyone, the Mongolian Government shall, by virtue of the relations of close friendship with the neighboring great Russian nation, previous to granting the concession, enter into conference with the Imperial Russian Government and consult with it as to whether the projected railroad is not injurious to Russia from an economic and strategic standpoint."

The closing of gaps between the Russian and Indian systems ought to benefit America's own trade relations with India, unless customs duties had to be paid in Russia for transit of goods to and from India and America. The time saved by transit of goods over this route, compared with transportation by sea, should be enormous. A railway service between Europe and India would give great opportunity for a fast parcel post service; up to the present the United States has not arranged parcel post service either with Russia or with India. The recent extension of the Russian railway system to Kola in northern Lapland,[2] and also the improvement in railway service to Archangel, should make it possible in connection with the proposed extension of the Russian railway system to British India, to ship goods all the way from New York to Arctic Ocean ports in Russia, and then by rail to British India, with no necessity for transfer of the goods either at London or at ports in Germany. As Kola is free of ice all the year round, it could be used for trade even in the winter, but in summer Archangel would be more advantageous, as much distance would be saved in railway haul. Indeed, by making use of steamers and barges on the Northern Dvina and Volga Rivers, with connecting canal, goods could be brought by water all the way to the Caspian Sea and across it to Turkestan, where the present and proposed railway systems could take them to British India. Owing to the high northerly position of Kola and also Archangel, the route to New York is not nearly so long as it looks on the maps in Mercator's projection generally in use for the representation of world routes. In the future America, instead of doing business with Russia or adjacent countries by way of England or Germany and through the Baltic Sea, seems likely to prefer the direct routes to northern Russia. The necessities of the present war, which have compelled the use of Russia's Arctic ports, have also caused their improvement and their better connection with the rest of the country, so that these new routes of commerce may become permanent.

There is no part of the world where railways are so capable of enormous commercial and industrial development as in Russia. The railway policy of the Russian Government is becoming more and more progressive, and as a result peaceful penetration of some of the richest and most secluded portions of the world will proceed rapidly during the years to come.

[2] See "Russia's War-Time Outlets to the Sea," *Geogr. Rev.*, Vol. 1, 1916, pp. 128-132, with map.—EDIT. NOTE.

THE GUARANI INVASION OF THE INCA EMPIRE IN THE SIXTEENTH CENTURY: AN HISTORICAL INDIAN MIGRATION

By BARON ERLAND NORDENSKIÖLD

There are, as is well known, two important Guarani tribes in Bolivia, the Chiriguanos and the Guarayús. The latter live between the Rio Itonama and the Rio Blanco, in that part of eastern Bolivia which is called after them Guarayos and which lies between the districts Mojos and Chiquitos. The Chiriguanos live in southern Bolivia from the Rio Itiyuro to somewhat north of the Rio Grande, in the outermost valleys of the Andes towards the Cran Chaco and in the Chaco itself.[1]

The Chiriguano Indians are mentioned in accounts of the history of the Inca Empire. They occupied much official attention in the first colonial days, and much has been written about them subsequently. Even in the seventeenth and eighteenth centuries their origin and history proved a source of great interest to writers, e. g. Guzman,[2] Techo,[3] Fernandez,[4] Guevara,[5] Lozano,[6] and Charlevoix.[7]

Guzman[8] relates that in 1526, following an order by Martim Affonso de Souza, four Portuguese, together with some friendly Indians from the coast, left San Vicente (now Santos) to explore the interior of the land. One of the Portuguese, called Alejo Garcia, was famous for his knowledge of the Guarani language. Traveling overland they first reached the Rio Paraná and, going through Guarani villages, came to the Rio Paraguay. They were well received by the inhabitants, whom they persuaded to accompany them westward on the voyage of discovery, from which they hoped to bring

[1] The Franciscan missioner, P. Fr. Bernardino de Nina, in his "Etnografía Chiriguana" (La Paz, 1912), describes (p. 5) the reduced territory now occupied by the Chiriguanos as extending "to the north scarcely as far as Abapó, to the south up to Itiyuru de Yacuiba, to the west as far as Monteagudo (Sauces) and to the east as far as Carandaiti: some hundred leagues from north to south and forty from west to east."

[2] Ruí Díaz de Guzman: Historia Argentina del descubrimiento, población y conquista de las provincias del Rio de la Plata (1612), in "Colección de obras y documentos relativos á la historia antigua y moderna de las provincias del Rio de la Plata, ilustrados con notas y disertaciones, por Pedro de Angelis," Vol. 1, Buenos Aires, 1836.

[3] N. del Techo: Historia Provinciæ Paraguariæ Societatis Jesu, etc., Liége, 1673; translation in Vol. 4 of Churchill's "A Collection of Voyages and Travels," 6 vols., London, 1732.

[4] Juan Patricio Fernandez: Relación Historial de las Misiones de los Indios, que llaman Chiquitos, que están á cargo de los Padres de la Compañía de Jesus de la Provincia del Paraguay, Madrid, 1726, p. 4.

[5] Guevara: Historia del Paraguay, Rio de la Plata y Tucuman, in "Colección Angelis," Vol. 2, p. 83.

[6] Pedro Lozano: Descripción chorographica del terreno, rios, arboles y animales de las dilatadisimas provincias del gran Chaco Gualamba: y de los ritos y costumbres de las innumerables Naciones barbaras e infieles que le habitan. Córdoba, 1733.

[7] François-Xavier Charlevoix: Histoire du Paraguay, Paris, 1757, Vol. 1, pp. 36, 258.

[8] *Op. cit.*, p. 15.

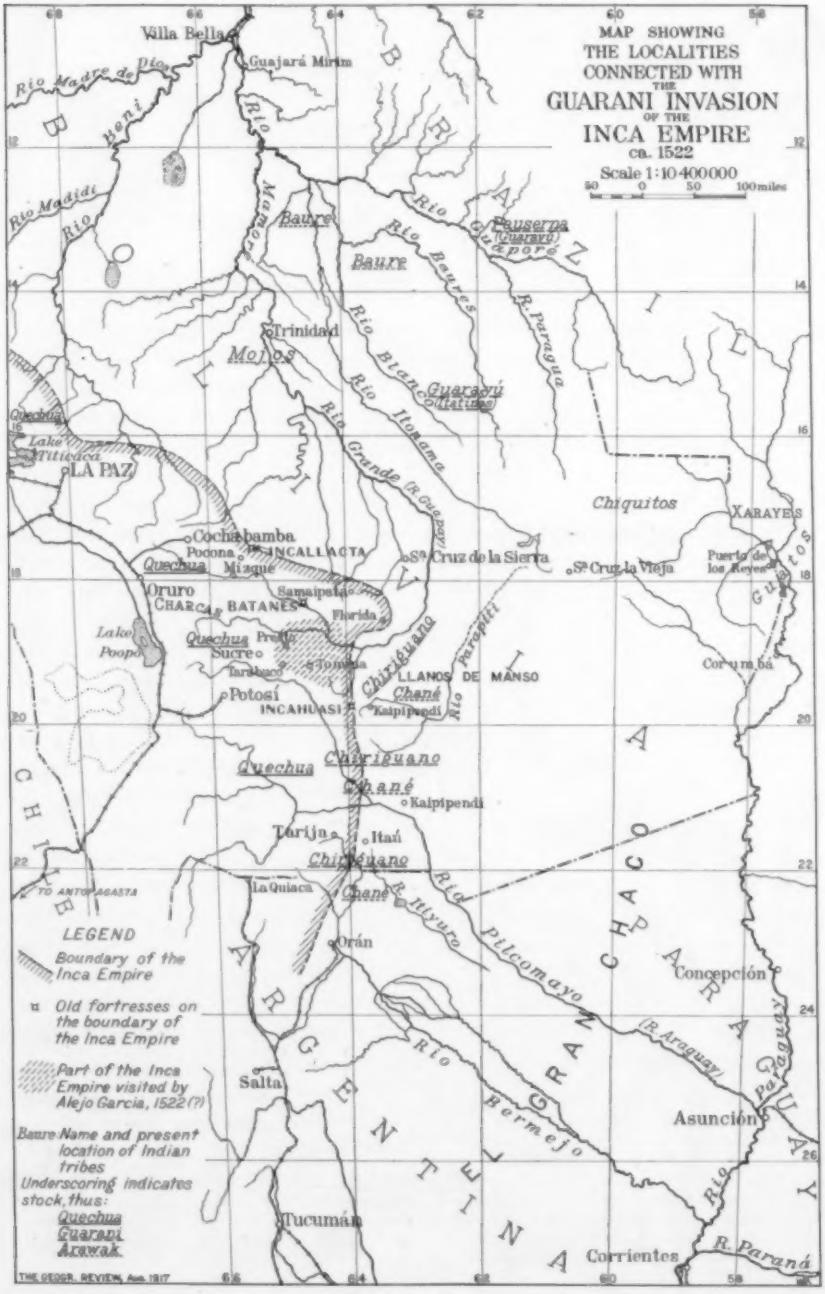

FIG. 1—Map showing the localities connected with the Guarani invasion of the Inca Empire, ca. 1522. Scale, 1:10,400,000.

back fine clothes and objects of metal, both for warlike and for peaceful uses.

Accompanied by two thousand Indians they came to a harbor on the Rio Paraguay called San Fernando. Others say that they left the Paraguay River a little north of Asumpción (Asunción) and, following a stream called Paray, crossed the plains, continuously fighting their way against the inhabitants. After many days' weary march they reached the mountains and invaded Peru in the territory between Mizque and Tomina. There, in some Indian villages ruled by the mighty Inca, they plundered and killed all whom they found. Then they continued for more than forty leagues as far as the outskirts of the villages of Presto[9] and Tarabuco. Numerous Charcas Indians advanced to meet them here, so they turned, retiring in such good order that they suffered no losses.

In consequence of this attack on their country the Incas had the whole boundary very carefully fortified with strong fortresses, in which they placed large garrisons. The fortresses still exist in these mountains, the Sierras de Cuzco-toro.[10]

When the Portuguese with their followers had reached the plain laden with their booty of cloth, clothing, metal utensils, and jewelry of silver, copper, and other metals, they returned to Paraguay by another and better route than that by which they had come, though even this was difficult enough by reason of hunger and war. From Paraguay Garcia sent two of his followers to Brazil to tell Martim Affonso de Souza about their discoveries. They took with them objects of gold and silver brought from the districts they had visited. Garcia, together with his followers, remained with the Indians in Paraguay. There he and his followers were murdered by the Indians, who only spared a boy, the son of Garcia. His name also was Alejo Garcia, and Guzman asserts that he knew him.[11] When the two messengers reached Brazil, they told of the riches they had seen in the territory of Charcas, as yet undiscovered by the Spaniards. In consequence of these accounts sixty soldiers under the leadership of Jorge Sedeño left San Vicente. These, too, were murdered by the Indians at the Rio Paraguay and the Rio Paraná. After this a great number of Indians left these parts and betook themselves to the territories where Alejo Garcia had been. Those who were from the Rio Paraná followed the Rio Araguay, better known by its Quechua name of Pilcomayo. It is these Indians who now live on the frontier of Tarija. Those who lived where Asunción now lies *"entraron por aquel rio sobre el rio del Paraguay, y Caaguazú,"* and the Indians higher up the river from Jeruquisaba and Carayazapera entered at San Fer-

[9] Presto is now a little place situated 75 miles northeast of Sucre. Tarabuco a larger one southeast of Sucre.

[10] Cf. Erland Nordenskiöld: Forskningar och äfventyr i Sydamerika, Stockholm, 1915, in which work several sketches of the ruins of these fortresses are published.

[11] In order rightly to estimate the value of Guzman's statements, it should be remembered that Guzman's father came to America with Cabeza de Vaca and that his mother was the daughter of Domingo de Yrala.

nando. It is these Indians who now live by the Rio Guapay (Grande) twenty leagues from San Lorenzo in the province of Santa Cruz. There all these Guarani Indians carried on a bloody war with the original settlers and made numerous slaves.

This is a summary of Guzman's highly interesting account of Alejo Garcia's invasion of the Inca Empire and the migration of the Guarani Indians from Paraguay westward.

Lozano[12] quotes Guzman from Techo and Fernandez, who also reproduce his account. He remarks that the similarity in language between Chiriguano and the language of the Indians in Paraguay speaks in favor of this migration theory, but that it is contradicted by Garcilaso de la Vega, the great authority on ancient Peruvian history. Garcilaso relates that Inca Yupanqui undertook a military expedition against the Chiriguanos. This is said to have been nearly one hundred years before Alejo Garcia's expedition, for Inca Yupanqui lived for many years after his war against the Chiriguanos. His successor was Tupac Inca Yupanqui, who ruled for many years. After him ruled Huayna-Capac, in whose reign "Alexo Garzia" penetrated into Peru.

Of the same opinion as Lozano was Charlevoix,[13] who also cites Guzman.

Following Garcilaso de la Vega, d'Orbigny[14] assigns Inca Yupanqui's struggle against the Chiriguanos to about 1430 and assumes that the Guarani, who, according to him, emigrated from Paraguay about 1541, mixed most with the Guarani Indians, who lived there first. D'Orbigny is ignorant of the fact that the Chiriguano territory is partly inhabited by another tribe, the Chané.

Of modern authors who have written about the Chiriguanos, Kersten[15] cites Guzman and Garcilaso de la Vega and, like Lozano and Charlevoix, puts more faith in the latter. Serrano y Sanz[16] takes the same point of view. Domenico del Campana[17] cites d'Orbigny. Church either does not know Guzman or ignores him.[18]

We see, therefore, that Garcilaso de la Vega is the sole authority for the belief of Lozano, Charlevoix, d'Orbigny, and others that the Chiriguanos inhabited the frontier of the Inca Empire in the Chaco long before Alejo Garcia's expedition. Garcilaso's account of the Inca Empire is, however, not always trustworthy. His description of the Chiriguano Indians is

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[12] *Op. cit.*, p. 57.

[13] *Op. cit.*

[14] Alcide d'Orbigny: L'Homme Américain, Paris, 1839, Vol. 2.

[15] Ludwig Kersten: Die Indianerstämme des Gran Chaco bis zum Ausgange des 18. Jahrhunderts. *Internatl. Archiv. für Ethnogr.*, Leyden, 1904.

[16] Manuel Serrano y Sanz: Los Indios Chiriguanaes. *Rev. de Archivos, Bibliotecas y Museos*, 1898, July, Madrid. The abundant bibliographical references and quotations from sources make this a particularly valuable work. In sequence (numbers for August to December) are described the Chiriguano attacks on the early Spanish settlers, the viceroy Francisco de Toledo's unsuccessful campaign against this indomitable tribe and other incidents of their participation in colonial history.

[17] Domenico del Campana: Notizie intorno ai Ciriguani. Florence, 1902. Contains a short bibliography.

[18] George Church: Aborigines of South America, London, 1912, edited by Clements R. Markham from the unfinished MS. left by author at his death.

FIG. 2—A Chané Indian, Rio Parapiti, Bolivia. (Figs. 2-8 are from photos by the author.)

fantastic and full of inaccuracies,[19] and he is clearly contradicted by other authors who were more reliable and less prejudiced than he in their accounts of the Inca Empire.

Thus Cobo,[20] whose work on the Inca Empire is regarded as reliable, says, like Guzman, that the Chiriguanos emigrated from Paraguay at the beginning of the sixteenth century. He states that the Chiriguanos penetrated into the kingdom of Peru almost at the same time as, or shortly before, the Spaniards. They left their country in groups and, ravaging as they went, wandered over four hundred leagues through the intervening provinces till they reached the districts bordering on the territory of Charcas. These districts they wrested from the original settlers and peopled in great numbers. Cobo farther on[21] relates that Huayna-Capac sent his leaders against the Chiriguanos and that the servants of the Incas fared badly.

Sarmiento de Gamboa,[22] who is also regarded as unusually reliable, gives a detailed account of the struggles of the Incas against the Chiriguanos. Like Cobo, he first mentions the Chiriguanos under the rule of Huayna-Capac. He tells us how that Inca visited Charcas, thence going to Pocona to give orders respecting the defence against the Chiriguanos and to repair a fortress that his father had built.

Furthermore[23] he relates that while Huayna-Capac was busy with the war in the north against the Cayambis, the Chiriguanos attacked Charcas and took the fortress of Cuzcotuyo, where the Inca had a large border guard against these Indians. They killed the whole garrison and plundered the country. Huayna-Capac received news of this in Quito and sent a chieftain called Yasca to Cuzco to summon the people and march against

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[19] Garcilaso de la Vega: Primera parte de los Commentarios reales, Madrid, 1723. English translation in *Hakluyt Soc. Publs.*, 1st Series, Vols. 41 and 45, 1869 and 1871.

On p. 244 Garcilaso gives the following incorrect and fantastic description of the Chiriguano Indians: "Las espias fueron, como se les mando, y bolvieron, diciendo que la tierra era malisima de montañas bravas, cienegas, lagos y pantanos, y mui poca de ella de provecho, para sembrar y cultivar, y que los naturales eran brutisimos, peores que bestias fieras, que no tenian religion, ni adoravan cosa alguna: que vivian sin lei, ni buena costumbre, sino como animales por las montañas, sin pueblo, ni casas, y que comian carne humana, y para la aver, salian a saltear las Provincias comarcanas, y comian todos los que prendian, sin respetar sexo, ni edad, y bebian la sangre quando los degollavan: porque no se les perdiese nada de la presa. Y que no solamente comian la carne de los comarcanos que prendian, sino tambien la de los suyos proprios, quando se morian; y que despues de averselos comido, les bolvian a juntar los huesos por sus coyunturas, y los lloraban, y los enterravan en resquicios de peñas, o huecos de arboles, y que andavan en cueros, y que para juntarse en el coito, no se tenia cuenta con las hermanas, hijas, y madres. Y que esta era la comun manera de vivir de la nacion Chirihuana."

[20] Bernabé Cobo: Historia del Nuevo Mundo (con notas . . . . de D. Márcos Jiménez de la Espada), Seville, 1892, Vol. 3, p. 61. The passage reads: "Los indios Chiriguanos, que siendo, como son, valientes y guerreros, casi al mismo tiempo, o pocos años antes que los españoles entrasen en este reino del Perú, salieron ellos, en cuadrillas de su patria, el Paraguay, y corriendo más de cuatrocientas leguas por las provincias que hay en medio, haciendo gran destrozo en los naturales délias, llegaron á las tierras que al presente poseen confinantes con la provincia de los Charcas, las quales quitaron á sus moradores, y usurpándolas para si, las tienen agora bien pobladas de los de su nación."

[21] *Ibid.*, p. 181.

[22] Pedro Sarmiento de Gamboa: Geschichte des Inkareiches, edit. by Richard Pietschmann, *Abhandl. der K. Gesell. der Wiss. zu Göttingen, Philol. Hist. Klasse*, N. S., Vol. 6, 1906, p. 105. English version in *Hakluyt Soc. Publs.*, 2nd Series, Vol. 22, 1907.

[23] *Ibid.*, p. 109.

the Chiriguanos. In the Collao (the Titicaca Basin region), too, Yasca collected people, whereupon he set off against the Chiriguanos, with whom he waged a fierce war. Yasca took some of these Indians prisoners and sent them to Huayna-Capac in Quito to let him see how curious they looked.

Further confirmation comes from Balboa,[24] who says that the Incas and Chiriguanos fought several combats without victory on either side. Like Sarmiento, Balboa says that Yasca sent a number of prisoners to Huayna-Capac. He left new garrisons in the border fortresses. Balboa also relates that when Huayna-Capac was in the Collao, he intended to invade the territory of the Mojos and the Chiriguanos but desisted when he learned of their poverty and savagery.

Cieza de Leon[25] speaks of Huayna-Capac's war against the Chiriguanos, saying that the people of the Incas fared badly and returned in flight.

Joan de Santacruz Pachacuti-yamqui Salcamayhua, too,[26] describes the attack of the Chiriguanos on the Inca Empire under Huayna-Capac. He says the Inca sent against them his most skilful chieftains with 20,000 Chinchaysuyo Indians. In passing he mentions the Chiriguanos under "Topayngayupanqui."

Of the authors here referred to who have written on the history of the Inca Empire, it will be seen that Cobo, Sarmiento, Balboa, Cieza de Leon, and Salcamayhua mention the attack of the Chiriguanos on the Inca Empire under Huayna-Capac, while none of them speak of these Indians in connection with any war under any previous Inca. Cobo plainly states that, shortly before or at the time of the discovery of the country by the Spaniards, the Chiriguanos migrated from Paraguay, and thus he confirms Guzman's statements. On the other hand Garcilaso de la Vega says nothing about the invasion of the Inca Empire under Huayna-Capac by the Chiriguanos, and I am inclined to think that by a mistake he assigned an event that happened under that Inca to the reign of his grandfather.

Guzman and his echoes mention a certain Alejo Garcia in connection with the migrations of the Guarani Indians westward. Who really was Alejo Garcia? When did he make his expedition? Were he and his followers the first Europeans to enter the Inca Empire?

To find an answer to these questions I have gone through all the literature at my disposal in which I could hope to find some information about this mystical conquistador and the westward migrations of the Guarani Indians at the beginning of the sixteenth century: in particular I have

[24] Miguel Cavello Balboa: Histoire du Pérou, in Ternaux-Compans, "Voyages, etc." 2d series, Vol. 4, Paris, 1840, p. 181.

[25] Pedro de Cieza de Leon: Segunda parte de la Crónica del Perú, in "Biblioteca Hispano-Ultramarina," published by Márcos Jiménez de la Espada, Madrid, 1880, p. 238. English translation in *Hakluyt Soc. Publs.*, 1st Series, Vol. 68, 1883.

[26] Joan de Santacruz Pachacuti-yamqui Salcamayhua: Relacion de antigüedades deste Reyno del Pirú. Contained in "Tres relaciones de antigüedades peruanas," Madrid, 1879, pp. 290-291 and 304. English translation in *Hakluyt Soc. Publs.*, 1st Series, Vol. 48, pp. 67-120, 1872. Markham dates the work about 1620.

looked for references antedating Guzman's work. Domingo de Yrala[27] states that when Juan de Ayolas began his march in 1537 through the Chaco, setting out from "El Puerto de la Candelaria" on the Rio Paraguay, he found among the Payagoa Indians a slave who had been with a certain Garcia, a Christian who conveyed to the island of Santa Catalyna a quantity of metal. The slave offered to lead him to the place from which Garcia had got this metal. Juan de Ayolas accepted the offer and succeeded in traversing the Chaco, but on the way back he was murdered by the Payagoa Indians. This was told Domingo de Yrala by a Chané boy from the interior of the country. On the Rio Paraguay in latitude 16° 30′ Yrala himself met many Indians, ex-slaves of Garcia's, who had fled to this place when the Guarani Indians murdered him. With these Yrala made a three-days' journey inland to speak with some Guarani Indians. They told him that it was a 15 days' march to the inhabited districts, and confirmed the fact that it was Garcia who had been murdering and plundering in the region.[28] It is clear from Yrala's statement that Garcia went overland from the south coast of Brazil to the Rio Paraguay.[29]

When in 1543 Alvar Nuñez Cabeza de Vaca made his journey to the upper Rio Paraguay, he, too, came across numerous traces of Garcia and of the westward migrations of the Guarani Indians. Cabeza de Vaca's journey has been described partly by himself and partly by his secretary Pero Hernández, and their accounts strike one as reliable.[30] Hernández relates, *inter alia*, that Cabeza de Vaca came to a tributary of the Rio Paraguay called Yapaneme. This was half as wide as the main river and ran into it in latitude 19°. According to the old residents, this was the way that Garcia, the Portuguese, came. With not more than five Christians he had warred in these parts at the head of a large number of Indians; he had fought many fights and had destroyed a number of villages. A mulatto, Pacheco, who had taken part in this expedition, returned to the land of the Guaçani,[31] by whom he was murdered. Garcia returned to Brazil. The Guaranis who had accompanied him had suffered great losses in the interior, and, said Hernández' informants, there were many individuals of this tribe who could give much information on the expedition and its consequences.[32] Hernández relates furthermore[33] that Cabeza de Vaca met Chané Indians whom Garcia had brought with him from the interior. These Indians, he

[27] Carta de Domingo de Yrala á S. M. dando extensa cuenta del estado de las provincias del Rio de La Plata, prision de Cabeza de Vaca, etc., 1545. Contained in: Relación de los naufragios y comentarios de Alvar Núñez Cabeza de Vaca, "Colección de libros y documentos referentes á la historia de America," Vol. 6, Madrid, 1906, p. 381.

[28] Domingo de Yrala, *op. cit.*, p. 392.

[29] *Ibid.*, p. 387.

[30] Relación de los naufragios y comentarios de Alvar Núñez Cabeza de Vaca, in "Colección de libros y documentos referentes á la historia de America," Vols. 5 and 6, Madrid, 1906. The Comentarios written by Pero Hernández are translated in *Hakluyt Soc. Publs.*, 1st Series, Vol. 81, pp. 94-262, 1891.

[31] Guarani?

[32] *Op. cit.*, Vol. 1, pp. 276-277.

[33] *Ibid.*, p. 291. "Algunos destos indios trayan quentas margaritas y otras cosas que dixeron aueries dado Garcia quando con el vinieron."

says, had taken wives in their new country, on the Rio Paraguay. A large number of Chané Indians came to meet the governor (i. e. Cabeza de Vaca), saying that they were well disposed to the Christians because Garcia had treated them well when he took them from their country. Some of them had necklaces and other objects given them by Garcia.

Cabeza de Vaca questioned the Chané Indians on the interior of the country[34] and its inhabitants. The chieftain of the Chané Indians, a man of about fifty, answered that when Garcia brought them there they passed through the territory of Maya. They then came to the Guaranis, who killed nearly all Garcia's Indians. However, the chieftain and others of his tribe had succeeded in escaping up the Rio Paraguay to the villages of the Sacoci Indians, where they had been well received. They had not dared to return by the road of the outward journey, lest the Guarani Indians should attack and kill them.

In the Xarayes district, on the upper Paraguay, the emissaries of Cabeza de Vaca met a Guarani Indian from Ytati.[35] Among other things, he related that, when he was very young, his tribe had united with all the inhabitants in the district to betake themselves to the interior of the country. He had accompanied his father and his relatives to fight the natives, from whom they took articles and adornments of gold and silver. After suffering a defeat in which a great number of Guarani Indians had been killed, the rest fled, remaining for the most part in the woods, through which they reached the interior. They did not dare to go back for fear of being killed by the Guaxarapo, Guato, and other Indians whose territories they would have to pass. He said that from the plundered villages they had taken many articles of gold and silver, *tembetas,* ear-drops, bracelets, fillets, axes, and little vessels, but that most of these had been recovered by the natives in their successful attack.

Hernández goes on to relate[36] that in El Puerto de los Reyes on the upper Rio Paraguay there were some Tarapecoci Indians. Like the Chané, they had come with the interpreter Garcia on his journey of discovery among the villages of the interior and had returned after being defeated by the Guarani Indians on the Rio Paraguay. These Indians said that they were not hostile to the white men, nay, that they liked them after Garcia had been in the country and had traded with them. But they were hostile to the Guarani Indians. Francisco de Ribera, who had visited their fellow-tribesmen in their native country, showed them some arrows from there, which they recognized and were glad to see. These Tarapecocis had gold and silver which they had bartered from the Payeunos, who in their turn had got these metals from the Chanés, Chiménos, Carcaras, Candires, and others.

From the accounts given by Yrala, Cabeza de Vaca, and Hernández we learn a good deal about the migrations of the Indians of this region in the

[34] *Ibid.*, p. 292. [35] *Ibid.*, pp. 304-307. [36] *Ibid.*, pp. 329-330.

FIG. 3—One of the Chiriguano villages that line the eastern foothills of the Andes from a little south of Santa Cruz to the Argentine frontier. The Chiriguano village is seldom large, being composed as a rule of eight or ten straw-thatched huts.

FIG. 4—Chiriguano Indians playing a stick game in Tihuipa, Bolivia, one of the villages at the eastern foot of the Andes.

beginning of the sixteenth century. We find corroboration of the occurrence of large migrations of Indians from east to west, and of the important part Garcia played in them. Numerous Guarani Indians from Paraguay wandered westward, and a number of them stopped in this region. Garcia took back to the Rio Paraguay Chané and Tarapecoci Indians, with whom he seems to have been very friendly.

Of great interest is the narrative of the Guarani Indian from Ytati on the migrations of his fellow-tribesmen from the Rio Paraguay, and their forced sojourn in the forests. These Indians from Ytati are evidently identical with the group of Guarani Indians who according to Guzman came from Jeruquisaba and Carayazapera on the upper Rio Paraguay and took up their residence on the Rio Guapay, twenty leagues from San Lorenzo in the province of Santa Cruz. In these parts there still lives a considerable tribe of Guaranis, viz. the Guarayú, whom I mentioned at the beginning of this article.

Just as Cabeza de Vaca had done, Nuflo de Chavez[37] and Francisco Ortiz de Vergara[38] found numerous traces of the westward invasion of these Guarani Indians.

Nuflo de Chavez got a very interesting and partly veracious description of the Inca Empire when he reached the province of Xarayes on the upper Rio Paraguay. He there met "Chirikuanos"—as he calls the Guarani inhabitants—who had taken part in the expedition westward: among them was a chieftain Bambaguazú. He described to Nuflo de Chavez the struggles between the "Chiriguanos" and the Candires, by which latter he meant the Indians of the hills. On the Chiriguanos' side were the chieftain Peritaguari and Moqueringuazú with all his men. There is also mention of "los Taguarinbueus" and of Itapuan's (Itapuay's?) and Guayubai's men. The whole movement was organized by Itapuay. When the "Chiriguanos" had passed the Rio Guapay, they saw the border village of the Candire country.[39] They had not succeeded in getting into this village, but had only stolen metal spades and tools from outhouses in the cultivated fields.

It is evident that Chavez got all this information from the "Chiriguanos" who live in Guarayos, i. e. from the Guarayú. It evidently relates to an expedition identical with that described to Cabeza de Vaca by the Indian from Ytati.

[37] Annua de la Compañía de Jesús—Tucuman y Perú—1596. Mision ó Residencia de Santa Cruz de la Sierra, "Relaciones Geográficas," Vol. 2, p. lxvi, Madrid, 1885. This includes (p. lxxxiii): Relación general que se tomó en pública forma y se envió autorizada al virrey en la provincia de los Xarayes que es en 17 grados sobre el Rio Paraguay, 250 [leguas?] de la Asumpcion donde habia llegado el general Nuflo de Chaves con 150 hombres, con orden é intento de poblar en ella, y despues, por la relación que tomó, pasó adelante.

[38] Al Ilmo. y Rmo. Sr. D. Juan Ovando, presidente del Consejo Real de Indias: Relación verdadera del viaje y salida, que hizo del Rio de la Plata al Peru, Francisco Ortiz de Vergara, su cierto servidor, in "Colección de Documentos inéditos del Archivo de Indias," Vol. 4, Madrid, 1865.

[39] These ruins should be looked for between Florida and Samaipata not far from Santa Cruz de la Sierra. I have met persons who stated that there were considerable ruins which they supposed to be of Jesuit, but which are presumably of Candire origin.

Ortiz de Vergara,[40] who in 1565 went from the Rio Paraguay to Santa Cruz in Chiquitos (i. e. Santa Cruz La Vieja) and from there to the Rio Parapiti, relates how the Guarani Indians had ravaged the country. He passed through large uninhabited tracts which the original settlers had abandoned through fear of the Guaranis.

The author of the "Relación Verdadera del Asiento de Santa Cruz [La Vieja]"[41] speaks of the Guarani Indians who lived thirty leagues from that place. He says that there are about 4,000 of them and that they came from the other bank of the Rio de la Plata after having eaten up or otherwise destroyed numerous tribes on the way. He also says that this country is fertile and abounds in fish, game, and wild fruits.

Juan Perez de Zurita[42] relates (about 1586) that these Itatines (Indians from Ytati) lived 35 leagues from Santa Cruz, in a fertile land of much food and water and great woods.

It is clear from what the Indians told Cabeza de Vaca and Nuflo de Chavez that the group of Guarani Indians who came from the upper Rio Paraguay did not succeed in making any conquests in the Inca Empire but only reached the boundary of that dominion. After their defeat they withdrew to the woods where, as has been stated, their descendants still live.

Unfortunately we cannot follow the migrations of the Chiriguanos in the same way as we have followed those of the Guarayús or Itatines. This is largely owing to the fact that they passed through the trackless wilds of the Chaco, through a region that baffled even the conquistadors of the sixteenth century. The author of the "Relación Verdadera"[43] alludes to the numerous attempts to make a road through the Chaco, all of which failed for lack of water or because of inundations.

He also relates that many Chiriguanos, when they passed to settle in the hills, died of thirst and snake-bites.

Blas Garay[44] has published an anonymous document from the Archivo de Indias which also confirms the statement that the Guarani Indians emigrated from Paraguay to Peru in the reign of Huayna-Capac. The author of this document says that some of the Guarani Indians returned to their country again, and that a thousand settled in the hills. It would be remarkable if the Guarani Indians who settled in the hills and caused the Incas so

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[40] *Loc. cit.*

[41] Relación Verdadera del asiento de Santa Cruz de la Sierra, límites y comarcas della, Rio de la Plata y el de Y-Guapay é sierras del Piru en las provincias de los Charcas, para el exómo Señor Don Francisco de Toledo, Visorey del Pirú, in "Relaciones geográficas," Madrid, 1885, Vol. 2, p. 154.

[42] Relación de la ciudad de Santa Cruz de la Sierra y su gobernación, calidad de tierra y otras cosas y la cual dió Juan Perez de Zurita, Gobernador que ha sido della, in "Relaciones geográficas," Madrid, 1885, Vol. 2, p. 171.

[43] *Loc. cit.*, p. 156.

[44] Blas Garay: Colección de documentos relativos á la historia de America, y particularmente á la historia del Paraguay, Asunción, 1899. (After Samuel A. Lafone Quevedo: Juan Diaz de Solis, Historia, Buenos Aires, 1900, Vol. 1, p. 180.) Lafone Quevedo assumes that this document was written about 1575 by Montalvo.

much trouble, numbered no more than one thousand.[45] Cazorla[46] estimates them, towards the end of the sixteenth century, at less than 600 and, with slaves, at 2,500. That they were comparatively few is confirmed by Lorenzo Suarez de Figueroa,[47] who distinguishes clearly between the Guarani Indians who lived in the province of "Ytatin" 30 leagues east of Santa Cruz (La Vieja), and those who lived 50 to 60 leagues west of that place. He estimates the latter at 4,000 warriors, not half of whom were true Chiriguanos, but mestizos, i. e. sons of these and of women of other tribes. Figueroa adds that they had four to five thousand Indians from "Los llanos del Capitan Andrés Manso," who were their subordinates. We see how, in Figueroa's time, the Chiriguanos were generally known as a conquering tribe which, shortly before, had taken possession of the country, a warrior race that had taken wives in a foreign land. However, their expansion seems to have been about the same then as now. In "Relación Verdadera"[48] we read that they had villages on the Rio Grande, Rio Condurillo (=Rio Parapiti), and Rio Pilcomayo. Their southern boundary was the 22nd degree of latitude.

According to Guzman, the migrations of the Guarani Indians westward began, as we have said, with the expedition of Alejo Garcia, which he asserts took place in 1526. He also says that Garcia was sent out by Martim Affonso de Souza. This last statement must be due to an error, for in the detailed diary in which Pero Lopez de Souza describes this expedition[49] there is no mention of Alejo Garcia. On the other hand, there is the statement that Martim Affonso de Souza met a certain Francisco de Chaves and five or six Indians on the south coast of Brazil. Chaves told him of great riches in the interior of the country, which induced Martim de Souza to send out an expedition under the leadership of Pero Lobo. The last-named was killed by the Indians. This is confirmed by Hernández.[50] Pero Lobo's unlucky expedition left the Brazilian coast for the interior in September, 1531.

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[45] The writer of "Carta del Licenciado Matienzo a S. M. sobre los Chiriguanaes, visitas y otros asuntos" (1561) says the Chiriguanos numbered 800 to 1,000: they were very dexterous in war, "que cincuenta acometerán á mill y aun á tres mil de los desta tierra." This letter from the Archivo de Indias is one of several documents containing references to the Chiriguanos reproduced in the "Juicio de Límites entre el Perú y Bolivia: Prueba Peruana presentada al gobierno de la República Argentina por Victor M. Maurtua," Barcelona, 1906. Vol. 2.

[46] Carta de Fernando Cazorla, etc., MS. Bib. Nacl. (Madrid) J 53, fol. 317, 318. Cf. Manuel Serrano y Sanz, *loc. cit.*, p. 572.

[47] Relación de la ciudad de Santa Cruz de la Sierra por su Gobernador Don Lorenzo Suarez de Figueroa, in "Relaciones geográficas," Vol. 2, pp. 165 and 167. Dated 2/6, 1586. Written?

[48] *Loc. cit.*, p. 155.

[49] Pero Lopez de Souza: Diario da Navegação 1530-1532, publicado por Francisco Adolfo de Varnhagen, Lisbon, 1839, p. 29: "Quintafeira desasete dias do mes d'agosto veo Pedro Annes Piloto no bargantim, e com elle veo Francisco de Chaves e o bacharel, e cinco ou seis castelhanos. Este bacharel havia trinta annos que estava degradado nesta terra, e o Francisco de Chaves era mui grande lingua desta terra. Pela informaçam que della deu ao Capitam Y., mandou a Pero Lobo com oitenta homẽs, que fossem descobrir pela terra dentro: porque o dito Francisco de Chaves se obrigava que em des meses tornada ao dito porto, com quatrocentos escravos carregados de prata e ouro. Partiram desta ilha, ou primeiro dia de setembro de mil e quinhentos e trinta e hum, os quarenta besteiros e os quarenta espingardeiros."

[50] *Loc. cit.*, p. 185.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 5—A Chané Indian, Rio Parapiti, Bolivia.
FIG. 6—A Chiriguano Indian, Tihuipa, Bolivia. Note the *tembeta*, or button-like ornament on the chin.
FIG. 7—A Chiriguano woman, Yacuiba, Bolivia.
FIG. 8—A modern Chiriguano burial urn, Kaipipendi, Bolivia.

Garcia seems to have made his expedition to the boundaries of the Inca Empire long before Pero Lobo started his expedition, and before 1526. This appears almost certain from the remarkable letter of the 10th of July, 1528, written by Cabot's fellow-traveler Luis Ramirez from the Rio Solís (Rio de la Plata),[51] in which he relates, *inter alia*, that Cabot met two of Solís' comrades on the south coast of Brazil in 1526, Enrique Montes and Melchor Ramirez, the latter of whom said that he had been on the Rio de Solís as interpreter to a fleet from Portugal. Many of the people in it had remained in the country, and five of them had gone to the hills, where there were said to be great riches and a white king who had proper clothes like theirs. From there they had sent a letter to say that they had not yet reached the mines, but that they had treated with some Indians who were neighbors to the hills and who wore on their heads a kind of silver crown and a kind of gold plate hanging round their necks and in their ears. They had sent twelve slaves and samples of metal and related that they had collected much metal. They invited the others to come to them, but they did not dare to because of the dangers and the many tribes through whose territories they would have to pass. Later had come the news that the Guarani Indians had killed them to take from them their slaves, loaded with metal.[52]

So far as I can see, there is no reason to doubt that Luis Ramirez' statement is, in the main, correct. It is to be assumed that he exaggerates somewhat when he speaks of the riches discovered. What he writes about the excursions of the Portuguese to the frontiers of the Inca Empire strikes me as absolutely truthful.

To judge by the evidence, he speaks of the same expedition as Guzman, Yrala, and Hernández, i. e. Alejo Garcia's. It appears from Ramirez' account that it must have been some years before Cabot's journey to Rio de la Plata (i. e. before 1526) that the Portuguese made their raiding expedition to the boundaries of the Inca Empire. Huayna-Capac died in 1526.[53] It is thus clear that the Portuguese and the Indians from Paraguay raided the boundaries of the Inca Empire in the later years of Huayna-Capac's

[51] Carta de Luis Ramirez: A document copied by F. A. Varnhagen in the library of the Escorial, *Rev. do Inst. Hist. e Geogr. do Brasil*, Vol. 15, 1888, Rio de Janeiro.

[52] Ramirez, *loc. cit.*, p. 20: " Este tambien dijó mucho bien de la riqueza de la tierra, el qual dijó haver estado en el Rio de Solis por lengua de una armada de Portugal; y el Sr Capitan General por mas se certificar de la verdad desto le pregunto si tenian alguna muestra de aquel oro y plata que decian n'otro metal que decian, los cuales dijeron quellos quedaron alli siete hombres de su armada sin otros que por otra parte se havian apartado, y que destos ellos dos solos havian quedado alli estantes en la tierra, y los demas vista la gran riqueza de la tierra, é como junto á la dicha sierra avia un rey blanco que traia buenos vestidos como nosotros, se determinaron de ir allá, por ver lo que era, los quales fueron y le embiaron cartas; y que aun no habian llegado á las minas, mas que habian tenido platica con unos indios comarcanos á la sierra é que traian en las cabezas unas coronas de plata, é unas planchas de oro colgadas de los pescuezos é orejas, y ceñidas por cintos, y le enviaron doze esclavos y las muestras del metal que tengo dicho, y que le hacian saber como en aquella tierra havía mucha riqueza, y que tenian mucho metal recojido para que fuesen allá con ellos los quales nose quisieron ir á causa que los otros havian pasado por mucho peligro, á causa de las muchas generaciones que por los caminos que havian de pasar havía, é que despues havian havido nuevas que estos sus compañeros bolviendose á do ellos estavan, una generacion de indios que se dicen los Guarenis los havian muerto por tomarles los esclavos que traian cargados de metal. . . . . .

[53] Cieza de Leon, *op. cit.*, p. 259; Cobo, *op. cit.*, Vol. 3, p. 189.

reign. That the Guarani Indians at this period attacked the Inca Empire, we know, as has been mentioned, also through Cobo, Sarmiento, Balboa, and Cieza de Leon.

Thus we see how very strikingly the statements from the authors who have written the history of the Inca Empire accord with those taken from the oldest descriptions of voyages of discovery in the basin of the Rio de la Plata.

As Pizarro and his companions did not reach the most northerly boundaries of the Inca Empire before 1526, it is clear that he and his companions were not the first Europeans to cross the border of that mighty kingdom. *Pizarro had a predecessor in Alejo Garcia.*

The "armada" on which the Portuguese came and plundered the borders of the Inca Empire was, according to Luis Ramirez,[54] that of Cristobal Jaques. This is a man about whose voyages we unfortunately seem to know very little.

Harrisse points out that in the *islario* of Santa Cruz mention is made of some islands in the estuary of the La Plata River which are named after Christoval Jaques, who, he says, was a Portuguese who came to this river from the coast of Brazil on account of the report that gold was to be found there. Harrisse says that it is not known how far up the La Plata Jaques went.[55] In this connection he lays stress on the fact that from the many Portuguese and Spanish ships that visited Brazil and the surrounding territories, seamen must have remained in the country after deserting, being shipwrecked, or abandoned on shore, and then joined some Indian tribe. They then went from tribe to tribe, wandering west and south. Harrisse continues: "In this way we can explain the unvarying tradition of Europeans having descended the great rivers of that part of the country in early times." In a note Harrisse mentions Alejo Garcia.

The most detailed account of Jaques that I have come across occurs in a book published by Lycêo Litterario Portuguez in Rio de Janeiro (1900), called "Historia Topographica e Bellica da Nova Colonia do Sacramento do Rio da Prata." The author of the introduction to this, J. Capistrano de Abreu, assumes, apparently on good grounds, that Jaques undertook two voyages to these parts. On the second voyage he did not reach the Brazilian coast before 1526 or 1527. The first voyage is supposed to have taken place between 1516 and 1521. Of the second voyage we know a good deal: of the first, which is of interest to us, we know very little, unless a document found in the archives of Simanca by J. T. Medina refers to this voyage. This is a letter from the Spanish minister in Portugal, Juan de Cuniga, to King Charles V. In it, Cuniga relates that in 1521 King Manuel of Portugal had sent to the Brazilian coast an expedition which had there met nine of

[54] Ramirez, *loc. cit.*, p. 37.

[55] Henry Harrisse: John Cabot, the Discoverer of North America, and Sebastian, His Son. London, 1896, p. 261. See also Franz R. von Wieser: Die Karten von Amerika in dem Islario General des Alonso de Santa Cruz, Innsbruck, 1908, p. 56.

Solís' companions. They had then continued up to a river which was fourteen leagues wide[56] and had gone thirty-five leagues up the river. There they heard a great deal of the riches in the interior of the country and got from the Indians silver, copper, and gold specimens.[57] If this was the expedition with which Alejo Garcia went to South America, he must have reached the Inca Empire about in 1522.

Guzman says nothing about *what* Indians the Guaranis met with in the districts where they settled. He only relates that they waged a very bloody war against the settlers and made numerous slaves. Cobo merely says that they conquered from their original inhabitants the tracts where they now live. Nor does Hernández say *what* Indians they were; but he tells us that Garcia had with him Chané and Tarapecoci Indians when he returned to the Paraguay River from his raid through the Gran Chaco. The Chanés are a very well known tribe in the Chaco. *They are Arawaks.* They still live in many parts within the territory of the Chiriguano Indians, as on the Rio Itiyuro in northern Argentina, near the mission of Itau south of the Rio Pilcomayo, not far from that river at Kaipipendi,[58] and above all on the lower Rio Parapiti. Everywhere they give the impression of being a tribe that has been pushed aside. They speak Guarani,[59] i. e. they are Guarani-ized, and have a civilization much resembling that of the Chiriguanos. It is therefore presumable that Chané Indians constituted at least a part of the original population in the present Chiriguano territory.

The Chiriguanos speak very contemptuously of the Chanés, whom they call *tapuy* or *tapii*, which, according to Corrado,[60] means that they are derived from something that has been bought. According to the same author they also call them *chirámui chiyari* (= my slave, my female slave), while a Chané addresses a Chiriguano as *cheya* (= my master). I have myself heard Chiriguanos contemptuously call the Chané Indians *cuñareta* (= women).

According to Matienço[61] a number of the Indians who were driven away from the districts conquered by the Chiriguanos settled in the Tarija valley. It is not known what Indians these were.

The Guarayú Indians, or Itatines, presumably conquered, from the Chané and other Arawak tribes, those districts, too, where they now live. In the "Relación Verdadera"[62] we read that the peaceful Indians who lived

[56] The Rio de la Plata.

[57] José Toribio Medina: Juan Díaz de Solís, Santiago, 1897, pp. cccxiii-cccxvi.

[58] Not to be confused with the Kaipipendi situated near the Rio Parapiti.

[59] On the Rio Parapiti they still know a little of their old Arawak tongue. Cf. Erland Nordenskiöld: Indianlif, Stockholm, 1910.

[60] Alexandro M. Corrado: El Colegio Franciscano de Tarija y sus misiones, Quaracchi, 1884, p. 54.

[61] Memoria del Licenciado Matienço al excelentissimo señor don Francisco de Toledo visorrey del Peru cerca del Asiento de la provincia de los Charcas, sobre el labrar de las minas, in "Coleccion de documentos inéditos," etc., Vol. 24, Madrid, 1875.

[62] Relación Verdadera, *loc. cit.*, p. 157: Of the Indians "en frente y al leste de Condurillo [Rio Parapiti]" is said "Estos indios eran naturales de los valles que están á los principios de la Cordillera que poseen los Chiriguanas, no de los que hay serca de los Charcas, como algunos han pensado, los cuales, echados de los Chiriguanas, se pasaron en aquella aspereza de tierras por escapar de sus crueldades, y defendiéndose bien y multiplicando en gran muchedumbre."

near the lower Rio Parapiti, presumably Chané, had been forced out there by Itatines. In their conquests these Indians certainly met not only Arawaks but also Chiquitanos. It would not surprise me if it was these latter warlike Indians who used the poisoned arrows that drove the Itatines into the woods which their ancestors inhabited and still inhabit.

We thus see that in large tracts of Bolivia now inhabited by Guarani Indians, the Arawaks presumably constituted the original population. In several earlier papers[63] I have had occasion to deal with this interesting tribal group, and I am convinced that future investigations will show that they had a still greater extent and importance than we are now aware of.

From the references in the sixteenth-century literature herein quoted, it seems clear to me that Guzman's account of Alejo Garcia and the expeditions of the Chiriguano Indians, described at the beginning of this paper, is in the main correct. Its only inaccuracy lies in associating Garcia with Martim Affonso de Souza and dating his expedition as 1526: it must have been some years earlier.

We therefore see:

(1) That at the beginning of the sixteenth century numerous Guarani Indians emigrated from the Rio Paraná and the Rio Paraguay to Guarayos and to the outermost valleys of the Andes towards the Gran Chaco.

(2) That the districts in which these Indians settled were not previously inhabited by Guarani Indians, but chiefly by Arawaks.

(3) That Alejo Garcia, the Portuguese, was in the Inca Empire before Pizarro.

Postscript

When I wrote the above paper I did not have access to Dr. Manuel Dominguez' excellent article on the Chaco. In this he clearly proves that Alejo Garcia was the first European to be in the Inca kingdom, thus arriving at the same conclusion as I had. As Dominguez does not give an account of the migrations of the Indians in connection with Garcia's plundering expedition, which migrations were of primary interest to me, I am still of the opinion that the publication of my paper is fully justified. Dominguez' article was published in the *Revista del Instituto Paraguayo*, Asunción, 1904, a periodical which is of course rare in European libraries. This also accounts for the fact that Dominguez' work is not quoted by several authors whose interest it would have been to know it.

[63] E. g. cf. Erland Nordenskiöld: Urnengräber und Mounds im bolivianischen Flachlande, *Baessler-Archiv*, Leipzig and Berlin, 1913.

THE CENTRAL ILLINOIS TORNADO OF MAY 26, 1917

By J. P. CAREY

A remarkably large and well-developed cyclone moved across the central part of the Mississippi Basin on May 26, 27, and 28. It was marked by atmospheric conditions that resulted in a number of exceedingly violent tornadoes, among them one of the most destructive that ever visited Illinois. The writer was at the State Normal School in Charleston at the time the largest of the tornadoes passed through and destroyed a part of the city lying about a mile north of the school. The weather conditions were noted

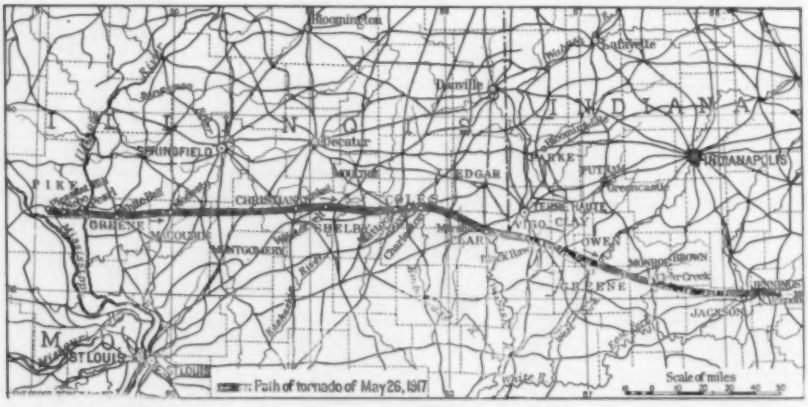

FIG. 1—Sketch-map showing the path of the tornado of May 26, 1917, across central Illinois and west-central Indiana. Scale, 1:4,200,000. The names of counties not in the tornado's path are omitted.

before and during the storm, and immediately afterward its destructive effects were observed from near Mattoon eastward for fifteen miles.

About noon of May 26, 1917, a tornado developed in Pike County, Illinois, near the little town of Pleasant Hill. Its path, which is about 287 miles long, stretches over almost the total width of Illinois and three-fourths of the width of Indiana, a length that is seldom attained by tornadoes. This distance was covered in seven hours and twenty minutes, or at an average velocity of about 40 miles per hour. This should not be confused with the velocity of the inflowing wind, which probably reached 400 miles an hour.

The tornado was remarkable for its severity as well as its length and was unusual in that it struck more towns than tornadoes generally do (see map, Fig. 1). It caused the deaths of over one hundred people and destroyed a large quantity of live stock, numerous farm buildings and other improvements, railroad cars, and portions of ten or more towns. These towns vary in size from a few hundred inhabitants to a city of 12,000. A conservative estimate of the total damage to real estate and personal property in Coles County, Illinois, is about $2,500,000 and for the whole track $3,000,000.

The greatest destruction was wrought in Coles County, where the tornado struck the districts occupied by workingmen's homes in the cities of Mattoon and Charleston, the former with a population of 12,000 and the latter with 6,000. The tornado passed through this county between 3 and 4 P. M., a time of day in which tornadoes are generally most disastrous. In Mattoon, at 3:30 P. M., sixty people were killed, and five hundred homes demolished and others seriously damaged. Traveling at about 45 miles per hour the storm struck Charleston, 11 miles east of Mattoon, at 3:45. Here, thirty-five persons were killed, over four hundred houses and fifteen industrial establishments partially or wholly wrecked, the two railway stations demolished, and all telegraph and telephone connections destroyed.

The width of the storm track varies from one-fourth to one-half of a mile, with an average of one-third of a mile. In some places minor damages resulted over an area about three-fourths of a mile wide to the south of the track. The storm's path indicates that the tornado swerved slightly in some places and in others rose high enough to prevent serious damage. A very good example of this is the case of the hamlet of Loxa, which lies midway between Mattoon and Charleston. Although this hamlet lay in the center of the path, it suffered only minor damages. Had the storm been as vigorous as in the two larger towns, Loxa would have been entirely razed. Another and more pronounced example of the lifting effect was found about four miles east of Charleston and one-half mile east of the Embarrass River. Here a farm house was smashed into splinters, and these splinters were blown a few rods into a gully, together with the farmer and his wife, who were killed, while twenty rods from where the house stood there is scarcely any evidence of vigorous wind action.

Destruction was greatest, in fact complete, in a zone from 500 to 700 feet wide to the right of the storm center's track. The sections of the two cities that were in this part of the storm track, with the exception of the heavier industrial buildings opposite the center of Charleston, were more completely demolished than if a gigantic roller had passed over them, for the buildings were broken into short sticks, split into narrow pieces, and some parts carried rods and even miles eastward. Inspection shows three zones of variable amounts of destruction: first, the zone of complete devastation; second, a zone from 300 to 500 feet wide to the left of the storm center's track, and a similar one of about the same width to the right of the devastated zone, where buildings were demolished beyond repair but not razed; and, third, a zone still farther to the right of the center, where damages decrease outward, from buildings moved to lifted roofs, fallen chimneys, and broken windows (see Fig. 6). The completeness of the destruction is exemplified by the accompanying photographs (Figs. 2, 3, 4, and 5). Objects to the right of the center were moved *forward and in* (east and north), while objects to the left of the center were moved *backward and in* (west and south). Trees and other objects which were near the center were felled either north

FIG. 2.

FIG. 3.

FIG. 2—A section of the devastated district, Mattoon, Ill.

FIG. 3—Coles County (Ill.) fair grounds after the storm. Formerly a beautiful park with numerous show buildings and barns. Nine race horses and a driver were killed here.

FIG. 4.

FIG. 5.

FIG. 4—Wreckage of two elevators at Charleston, Ill. The building at the left was of heavy paving brick. This was near the storm's center.

FIG. 5—Remains of the gas plant at Charleston, Ill., a brick structure.

or south; in fact, the position of such objects furnished the datum for establishing the path of the storm's center.

The reason for the location of the area of complete devastation to the right of the center seems to be plausibly explained when the agents of destruction are considered. On the right of the center the explosive action due to the reduced pressure on the outside of the buildings, the eastward component of the counter-clockwise wind of the tornado (probably over 400 miles per hour), the forward movement of the storm, and the west wind which was prevalent at that time, all worked in conjunction as agents of

FIG. 6—Charleston (Ill.) high school, a building in the zone of partial destruction.

destruction; while on the left side of the center the westward component of the counter-clockwise wind was partially counterbalanced by the forward movement of the storm and the prevalent west wind. A deduction from this is that the greater the rate of transition of the storm, other conditions being equal, the less the destruction to the left of the center. However, the backward or east wind of the storm was strong enough to move an eight-room, one-story house 41 feet to the westward (see Fig. 7), others shorter distances, to break elm trees as large as 30 inches in diameter (see Fig. 8), and to throw down a large number of monuments in a cemetery in Mattoon.

Evidence of the explosive action so frequently cited as the principal agent in tornado destruction is not lacking, but certainly it is not as general as one would expect. The north ends and the east roofs were pulled from some houses in the partially demolished districts; plate-glass windows were broken and fell out, and it is curious to note that the glass in lower sashes was broken more often than in the upper sashes; in one of the churches and in a store in which the glass was supported by metallic strips the windows were made convex, as also were the walls of a barn; one well containing

FIG. 7.

FIG. 8.

FIG. 7—View on the left side of the storm track. The house was moved 41 feet west and 12 feet south from where the man is standing.

FIG. 8—Broken tree overthrown to the west, i.e. on the left side of the storm track.

fourteen feet of water was sucked dry, and a quantity of water and a number of bricks of the curb of another well were removed; every article of furnishing, beds, dressers, chairs, rugs, and a large cedar chest, was sucked from the second floor of one house, and, except for the loss of windows and sashes, the house was uninjured; two negroes were stripped of all their clothing; and many birds were plucked clean of feathers. These cases all testify to the explosive and sucking actions, so-called, of the storm, which were caused by the great reduction of pressure as a result of the centrifugal movement of the air. Although the strong twisting wind appears to have been the chief agent of destruction, it is quite probable that, in and near the center of the storm, explosion was an important factor in preparing buildings for the subsequent crushing action of the wind.

Cases occurred of the well-known phenomenon of objects being driven into trees. Blunt cedar sticks were found imbedded an inch and a half deep in posts, and oat-straws half an inch deep in a maple tree. Another tree was decorated like an Indian's feather helmet. Huge oak and elm trees were twisted off, freight cars filled with brick were upset, as were also the tank cars of the Standard Oil Company. These things, and the buildings moved and crushed, indicate the force of the wind.

That the atmospheric disturbance reached a considerable height or that there was a continuous upward movement of the air, or both, is evidenced by the distance and direction to which mail, pieces of books, photographs, wall paper, and fragments of lath and plaster were carried. A large amount of such material was carried from Mattoon and Charleston to Parke and Putnam Counties, Indiana, according to reports received and mail sent back from Bloomingdale and Greencastle. This means that material was carried from 50 to 70 miles to the northeast, while the storm went southeast.

Phenomena which, for want of an explanation, are termed freaks were quite common. It was not unusual to see a house that was unharmed standing next to a building wrecked beyond repair. One of the accompanying photographs (Fig. 4) shows a section of Charleston in which small houses were not much harmed, while near them two well-built elevators and a number of freight cars were completely demolished. To the east and west of this same dwelling section the destruction was quite complete. This section of minor destruction is directly north of the business part of Charleston, and, although it is as much as three blocks distant from the zone in which the storm was generally effective, a number of store buildings in it were severely wrecked. The inference is that there the storm cloud settled down and covered a wider area, with the result that its force was somewhat dissipated and its destruction more extensive and less intensive.

Meteorological Conditions

The U. S. Weather Bureau daily weather map for St. Louis at 7 A. M. of the date of the storm (Fig. 9) shows a well-defined cyclonic area covering most of the interior lowland of the United States. The center of the low,

which has a barometric pressure less than 29.4 inches, is in the vicinity of Sioux City, Iowa. Forty-eight hours later it had moved southeastward, so that the center was about Cincinnati, Ohio, and the pressure near the center of the low had increased to 29.5 inches. This is a movement of 600 miles in 48 hours, or an average of 12.5 miles per hour, an unusually slow rate for the movement of cyclones in the United States. The center of the low was in southeastern Iowa at the time the tornadoes occurred in Illinois; thus

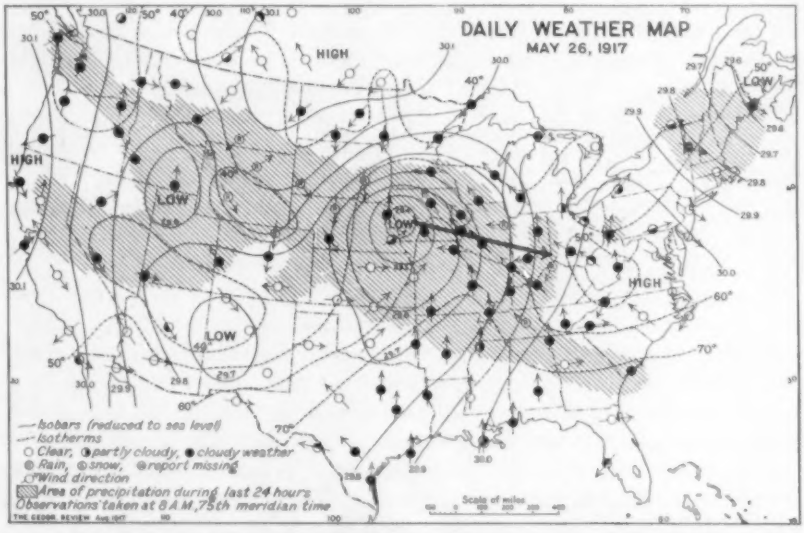

FIG. 9—Copy of the daily weather map of the U. S. Weather Bureau for May 26, 1917, issued at St. Louis, Mo. Scale, 1:42,000,000. The double-line arrow indicates the progress of the low-pressure area from western Iowa to southeastern Indiana during the forty-eight hours from 7 A. M. (Central Time) on May 26 to 7 A. M. on May 28.

they developed in the southeastern quadrant of the low area. This low is remarkable in that the isobaric lines are oval in shape, with their long axis extending north and south. The isobars also show a slight bulge to the south in the southern quadrant—a condition favorable for sudden wind shift. A low of this shape and size in the middle Mississippi Valley in the spring and early summer months is especially favorable for the development of tornadoes. Cloudiness was prevalent and showers were common over most of the Mississippi Valley during the 24 hours preceding the tornadoes.

At 11 A. M. a thunder shower occurred at Charleston. The clouds broke for a short time, but lights were necessary at 2 P. M., and the air was exceedingly sultry and oppressive. At 3 P. M. a heavy, black nimbus cloud appeared in the northwest, and frequent and fierce flashes of lightning occurred. Shortly before 3.45 a greenish-black cumulo-nimbus cloud began to tumble in from the west. The wind suddenly changed from east to west through the south, and hail began to fall. Then the hail lessened in amount

and the wind attained a velocity of probably 80 miles per hour (judging from the trees broken and the material carried), the barometer dropped nearly 0.30 inch and rose immediately 0.40 inch and as suddenly returned to its starting point, the temperature fell 14° and then rose gradually (see barograph and thermograph records, Figs. 10-11). Suddenly the wind lulled, and flattened speroidal hailstones, some having a major axis of 2¼ inches, fell until the ground was covered. The hail was accompanied and followed by a deluge of rain. The precipitation was 1.81 inches for the 24 hours, and all but a very small part of this fell during the two hours immediately after the passage of the tornado.

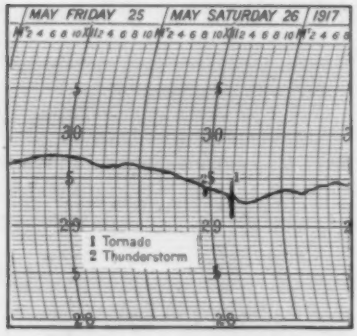

FIG. 10—Barograph record made at Charleston, Ill., one mile from the storm center.

Although the funnel or balloon-shaped cloud of the tornado was not visible to those in the cities, because of the trees, it was well described by numerous individuals who were west of the cities and to the right or left of the storm. Most of the people of the two larger cities who observed the action of the clouds maintain that two clouds or storms, one moving southwest and the other northeast, came together. It is curious to note that these reports came from two places eleven miles apart and that observers between the cities reported the funnel cloud. The explanation is probably this: When the view of the lower part of the funnel cloud is obscured, or the cloud has settled very low, the clouds at some distance from the earth and on the right or south side of the storm appear to be and really are coming in from the southwest, while those on the left or north side are moving west and south. The eastward and westward movements of the clouds are not perceptible to the observer in front of the approaching storm, and he sees only the northward and southward movements, and thus the clouds appear to be meeting. Furthermore, since the clouds on the south and east sides of the storm are moving toward the observer and are on the front of the storm, they are apt to contain more dust and less moisture than the backward moving clouds and therefore appear lighter in color.

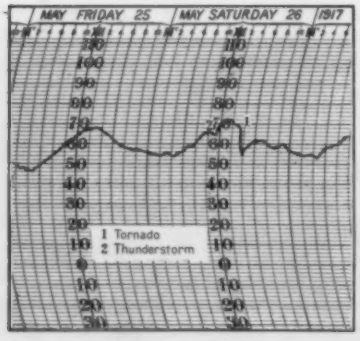

FIG. 11—Thermograph record made at Charleston, Ill., one mile from the storm center.

RAINFALL TYPES OF THE UNITED STATES

By ROBERT DeC. WARD
Harvard University

Importance of Rainfall Types

"When does the rain come?" is a question the correct answer to which often concerns the farmer and the engineer more than does the answer to the question "How much rain falls in a year?" A relatively small amount of precipitation may be so distributed that most of it comes just when the crops have the greatest need of it. In our own country, great progress has been made in agriculture, especially in the semi-arid regions, through the selection of crops whose periods of growth and of maturity coincide with the season of most abundant rainfall. In earlier years, failure often resulted from an attempt to raise crops which were not adapted to the rainfall type of their particular district. Soil conditions depend to no small degree on the season at which most of the rain falls. There must inevitably be a considerable difference in the processes of weathering between two places, one of which has dry summers and the other of which has rainy summers. The rainfall type is thus both directly and indirectly important in agriculture: directly, as furnishing the rainfall for the immediate use of the plants, and, indirectly, through the relation of the rainfall season to the processes of weathering and of soil formation. The water available for mills, for electric-power plants, for irrigation, for water supply also depends upon the rainfall type. The latter determines the size of the reservoirs, the length of the period needed for the storage of the water, the loss by evaporation, in short, the general availability of the water supply. The desirability of a region as a health or as a pleasure resort depends largely upon the season at which the most or the least rain falls.

Our Rainfall Types and the Method of Illustrating Them

The rainfall types here adopted are based upon an examination of a large number of plotted monthly rainfall amounts for selected stations in all parts of the United States and upon a revision, on the basis of these curves, of the rainfall types suggested by General A. W. Greely[1] and by Professor A. J. Henry.[2] Greely's rainfall types are very simple. There are but six in all. Each has characteristically a single maximum and a single minimum. Each pertains essentially to a single body of water. Composite

[1] A. W. Greely: Rainfall Types of the United States, *Natl. Geogr. Mag.*, Vol. 5, 1893, pp. 45-58, Pl. 20.

[2] A. J. Henry: Rainfall of the United States, With Annual, Seasonal, and Other Charts, *Weather Bur. Bull. D*, U. S. Dept. of Agric., Washington, 1897, 58 pp. [Pp. 11-13 and Pl. 1 concern rainfall types.]
Idem: Climatology of the United States, *Weather Bur. Bull. Q*, U. S. Dept. of Agric., Washington, 1906, 1012 pp. [Pp. 50-51 and Pl. 27 concern rainfall types.]

types are purposely omitted. Henry's classification embraces ten types. Several of these are closely identical with those of Greely. They have been illustrated by means of a series of diagrams showing the monthly rainfall amounts in percentages of the annual means. They include complex (double maxima and minima) as well as simple types. Other suggestions regarding rainfall types are referred to in the general bibliography at the end of this paper.

Each type or sub-type of the present writer's classification is illustrated by a curve showing the monthly amounts of rainfall. These curves are composites. Each one is based upon the records from several (usually five or six) stations, in the same general district. There is a distinct advantage in using a composite instead of the curve for a single station. When the data for several stations are combined, individual local peculiarities and errors, arising from the topography, the altitude, the exposure of the gauge, and from other local controls, are to a considerable degree neutralized. For the purposes of a general comparative study, the composite curve is thus more useful than the curve for a single station. Two things should be borne in mind when considering rainfall types. First, it must not, of course, be expected that the curve for any individual station will necessarily agree absolutely with the type curve for the district, which is a composite. These composite curves show the dominant type of rainfall distribution over the areas for which they have been selected as illustrations. Many individual stations over these same areas naturally depart more or less from the type, especially towards the margins of the areas. Second, the distribution of rainfall at a station in any given year often differs considerably from the general type, which is based upon the records of many years.

Each of the accompanying curves is plotted on the same scale. The height of the diagram therefore gives, at a glance, an indication of the amounts of rainfall. The approximate annual rainfalls over the district for which the curves are representative are noted in each case. Although the type, and not the amount, is here under discussion, some general idea of the monthly amounts of precipitation is inevitably gained by even a hasty glance at the curves, and it will be useful, in our further study of rainfall, if we incidentally learn something about the annual amounts. The general location of each type is indicated on the accompanying map (Fig. 1). The solid black lines indicate the climatic subdivisions or provinces of the United States which have been suggested by the present writer.[3] These provinces form a convenient and rational basis for a discussion of the climatology of the United States. Although suggested and adopted for other reasons, these subdivisions are on the whole well adapted for use in our present investigation. Except in the few cases where well-

[3] R. DeC. Ward: The Climatic Subdivisions of the United States, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672-680. [Abstract in *Monthly Weather Rev.*, Vol. 43, 1915, pp. 467-468.]

defined mountain barriers intervene, as in the case of part of the Sierra Nevada-Cascade and Rocky Mountain divides, one rainfall type naturally merges gradually into the neighboring one. There are, therefore, few sharp division lines. The boundaries shown on our map are not to be taken as indicating sudden transitions.

Rainfall Types of the Eastern Climatic Province

The outstanding fact regarding the seasonal rainfall over most of the great area which lies east of the Rocky Mountains is the predominance of summer rains. Such a distribution is entirely in accord with the general

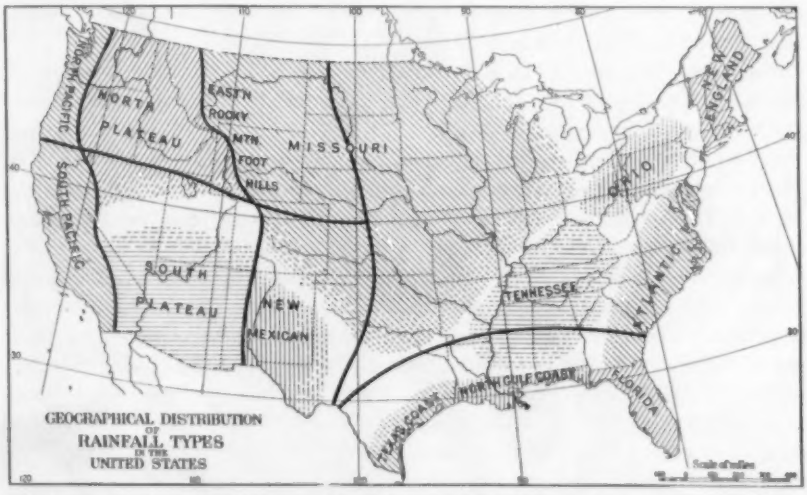

Fig. 1—Outline map, 1:42,000,000, showing, in ruling, the distribution of the rainfall types and, by heavy black lines, the climatic provinces of the United States. The latter, which are left nameless above, are taken from a map on p. 678 in the article by the author cited in footnote 3, above. Proceeding from east to west the names of the climatic provinces are: Eastern Gulf, Northern Plains, Southern Plains, Northern Plateau, Southern Plateau, Northern Pacific, Southern Pacific.

continental character of the climate of this area as a whole. Warm-season rains are typically the rains of continental interiors. They occur when the continental indraft of the warmer months brings in warm, damp air from the surrounding water areas and when high temperatures favor local showers.

The most characteristic rainfall type of our Eastern Province, both because it covers the largest area and because its curve so emphatically indicates continental control, is that which, following Greely, is named *Missouri*. This type prevails over most of our Plains Province, extends eastward well over the prairie states and into the Great Lakes region, and is found as far south as northern Texas. Figure 2 is a composite curve illustrating the Missouri type. The winter precipitation is very light.

Most of the year's supply of rainfall comes in late spring and early summer. The maximum is usually in June. Similar conditions are found over the Russian steppes, as pointed out by Woeikof. This type of rainfall brings the maximum at the season when rainfall is most needed by the crops. While such a distribution may be of relatively little importance in a region where the total annual precipitation is more than enough for agricultural uses, it is obviously of great moment where the year's rainfall at best scarcely suffices for the demands of our staple crops. Fall-sown grain over most of the Eastern United States grows little or not at all in winter. It makes a rapid start in spring, and therefore the months from April to August are the most critical for our Eastern staple crops.

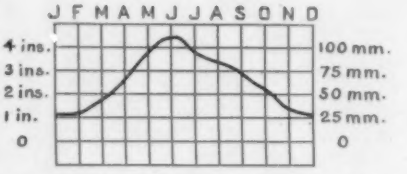

FIG. 2—Missouri type. Mean annual rainfall, 20-30 inches.

While the area embraced by the Missouri type is very extended, the general character of the curve is maintained with extraordinary persistency. Towards the margins of the district, to the east, south, and west, certain modifications are noted. A number of stations around the Upper Lakes, e. g. in eastern Minnesota, eastern Wisconsin, the upper peninsula of Michigan, etc., have the Missouri primary maximum in June and a secondary maximum in September. In going east, also, as the vicinity of the Lower Lakes and of the Ohio Valley is reached, the precipitation of the winter months becomes distinctly more marked. We may, therefore, set apart the *Ohio* type, whose general location is indicated on our map (Fig. 1) and whose curve is illustrated in Figure 3. The continental summer maximum of the Missouri type, here somewhat retarded into July, is still clearly shown, but the increase in winter rainfall and the resulting smaller annual range are marked. The location of this Ohio area in a part of the country where cyclonic rainfalls are both frequent and abundant, and where the winter and spring cyclones from the Southwest and from the Gulf of Mexico are particularly heavy rain-bringers, sufficiently explains the wet winters of the Ohio type. The winter precipitation of the Ohio type is heavier than that in the Great Lakes region generally and is more often rain, while over the Great Lakes themselves, especially the Upper Lakes, more snow falls.

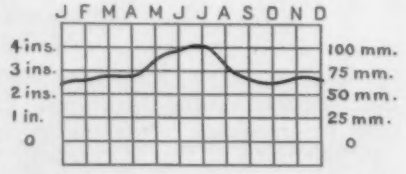

FIG. 3—Ohio type. Mean annual rainfall, 35-40 inches.

Still farther east the distribution of rainfall through the year becomes more and more uniform, especially as we approach that interesting northeastern section of our country which, sooner or later, comes within the rain

area of most of the storms which pass over the United States. In the type which we may call *New England* we have the most uniform distribution of precipitation which prevails anywhere in our whole country (Fig. 4). The variation from month to month is too slight to be of any economic importance. Droughts are about as likely to occur in one season as in another, but are, of course, more critical in summer. Throughout the year there is usually enough water to keep the rivers well supplied and available for power. We can hardly speak of any maxima and minima, although August, in the long run, is somewhat the rainiest month. This, as will be seen in a moment, is a marked characteristic of our seaboard district along the southern Atlantic coast. The New England curve is obviously affected by controls which dominate the rainfall types of adjacent regions. Some of the stations show a tendency to a slight November maximum, which is a characteristic of the St. Lawrence Valley (Greely). This uniform distribution of rainfall is seen, more or less clearly, over the area directly west and southwest of New England. New York City, Philadelphia, Washington, all have rainfall curves which do not differ greatly from the composite shown in Figure 4, or from the curve of Boston. With increasing distance from the coast, the tendency toward a mid-summer (July) maximum becomes more marked.

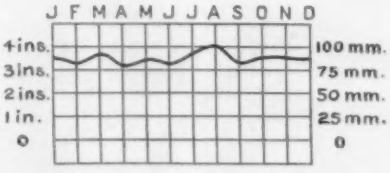

FIG. 4—New England type. Mean annual rainfall, 40-45 inches.

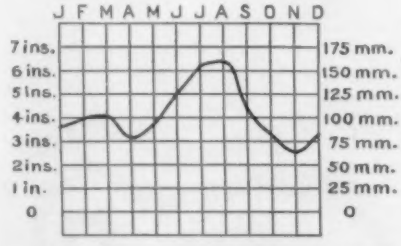

FIG. 5—Atlantic type. Mean annual rainfall, 45-50+ inches.

Farther south, over the Atlantic Coast states lying between Virginia and Florida, there is a well-defined late summer maximum, usually in August; a minimum in middle or late autumn (October or November); a secondary maximum in late winter (March); and a secondary minimum in spring (April). Von Hann has selected the Atlantic coast of North America in latitude 40°N. as being a typical example of extra-tropical coast rains with a dry spring. The remarkably uniform distribution of rainfall throughout the year is peculiar to this particular district. The percentages of rainfall by seasons are as follows:

Dec.–Feb.	*March–May*	*June–Aug.*	*Sept.–Nov.*
24	23	27	26

This type, which is best termed the *Atlantic*, gradually merges on the north into the very uniform rainfall distribution just considered, which attains its most characteristic development in New England. On the south,

the Atlantic type merges into that of Florida. Figure 5, based on records from stations in North and South Carolina and Georgia, illustrates the Atlantic type. The late summer maximum, which is best marked on the coast, is controlled by the frequent and heavy thundershowers of the warmest months, together with the additional precipitation which comes in connection with occasional West Indian hurricanes. The winter rains result from the general cyclonic storms of that season. The Atlantic type, with its abundant supply of rainfall throughout the year, is obviously well adapted to furnish water-power at all seasons, while its warm-season maximum is favorable for crops.

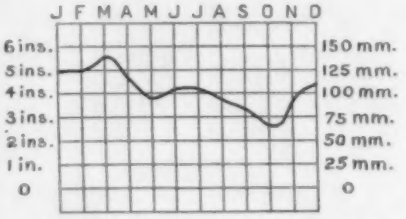

FIG. 6—Tennessee type. Mean annual rainfall, 45-55 inches.

Over the whole great region east of the Rocky Mountain divide there is but one rainfall type which has a single maximum in winter. This prevails over Tennessee and parts of the adjoining states, especially those immediately to the north and south, and was therefore named the *Tennessee* type by Greely. Because of its prevalence over the southern portions of the Appalachian Mountains, Henry has called it Southern Appalachian and Tennessee. The curve given in Figure 6 illustrates this type. There is a single maximum in late winter or early spring (March), and a well-marked minimum in mid-autumn (October), when the general storm control is relatively inactive. Droughts are not infrequent in the autumn, with damage to crops. Towards the margins of the Tennessee area, both on the east and south, the tendency to a second maximum in middle or late summer is very noticeable. The warm and damp southerly winds of the cyclonic storms of late winter and spring which cross this area on their way north from Texas or the Gulf are responsible for the heavy rainfall of the Tennessee maximum, just as they bring the winter rains of the Ohio type, previously noted. These late winter and early spring rains not infrequently cause floods in the rivers of this region. Topography is an important factor in causing locally excessive precipitation.

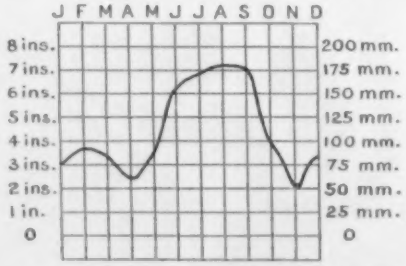

FIG. 7—Florida type. Mean annual rainfall, 50-55 inches.

RAINFALL TYPES OF THE GULF PROVINCE

The Gulf climatic province is overlapped, on the north and northeast, by the Tennessee and the Atlantic types. Its own rainfall distribution is

rather complex and cannot be generalized into a single type. As a whole, the rainiest season is late summer or early autumn. These conditions are satisfactorily explained by the fact that the warm and moist prevailing summer winds over this area come directly from the Atlantic Ocean and from the Gulf of Mexico, that thunderstorms are of frequent occurrence, and that local cyclonic depressions and West Indian hurricanes contribute their share of precipitation. Although our Gulf Province is a small one, three distinct rainfall types may be distinguished. The type which may well be called the *Florida* type is distinctly tropical in character (Fig. 7). June to September constitute a true rainy season. August and September are generally the rainiest months. These are local convectional rainfalls. Florida is also much exposed to tropical hurricanes, which all too often bring their characteristic destructive gales and flooding downpours. A faint secondary maximum is noted in winter. Because of the dry autumn and spring in northern Florida much interest has there been taken in subsurface and surface irrigation. Along the northern Gulf coast there is a complex type which we have called the *North Gulf Coast* type, with a late winter and early spring secondary maximum, similar to the primary maximum of the Tennessee type, and a primary mid- or late summer maximum (July-August) which suggests the Atlantic type (Fig. 8). The tendency towards the August-September maximum of Florida becomes more and more marked as we go eastward along the northern Gulf coast. On the Texas coast there is a marked early fall (September) maximum, as illustrated in Figure 9. This we have designated the *Texas Coast* type. The curve is so different from the two other curves of the Gulf Province that it deserves a special name, although it occupies but a limited area on the coast of Texas. Farther inland, Texas stations show more and more tendency towards an earlier maximum, like that of the Missouri type, and there is an intermediate belt of country in which a transition type is found, with the September maximum of the coast and the early summer maximum of the interior.[4]

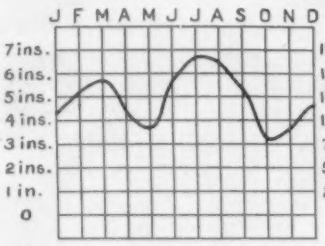

FIG. 8—North Gulf Coast type. Mean annual rainfall, 55-60+ inches.

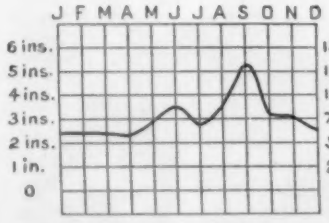

FIG. 9—Texas Coast type. Mean annual rainfall, 25-45+ inches.

[4] A. W. Greely: Some Peculiarities in the Rainfall of Texas, *Bull. Philos. Soc. of Washington*, Vol. 12, 1892, p. 53.

Rainfall Types of the Plains Province

The dominant rainfall type over the Northern Plains is that already described as the Missouri (Fig. 2). The economic importance of this type of rainfall is much greater over the Plains, where the annual rainfall is either insufficient or barely sufficient for agriculture, than it is farther east, where the annual precipitation is heavier and the season at which the rain comes makes less difference. It may without exaggeration be said that, if a man were allowed 20 inches, or less, of precipitation a year and were told to distribute this amount throughout the year so that it might be of the greatest benefit to the crops over an area like that of our northern and central Great Plains, he could not devise any type of distribution more favorable than that of our Missouri type. The moisture which supplies these beneficent rains comes chiefly from the Gulf of Mexico, but probably also to some extent from the waters of the Great Lakes. The spring and early summer maximum is essentially due to thundershowers, both those which are simply local convectional overturnings of heated air (heat thunderstorms) and those which occur in connection with the relatively weak cyclonic depressions of the hotter months. These summer rains are important in supplementing the water supply which is obtained by the use of the rivers. As pointed out by Greely,[5] "it is well known that the annual rainfall is small, yet eastern Nebraska receives, during these four months, April to July inclusive, a larger amount of rainfall than the interior portions of the eastern states from Maine to Virginia; and western Nebraska receives only a slightly lesser amount." These rains of spring and early summer are either of direct benefit, in falling upon the growing crops, or of indirect benefit, in coming at a time when they are of most use for irrigation. It is readily seen that there is a distinct advantage in having the rainfall maximum over before the harvesting season. Hay and grain may thus be left outdoors with little danger of injury by rains. The relatively dry autumns are favorable to the occurrence and spreading of "prairie fires," about which much used to be heard. The very moderate winter precipitation, which is mostly snow except in the southern sections, has the advantage of being generally so light and dry that the cattle ranges are not rendered inaccessible. It is, furthermore, an excellent protection for the forage grasses and keeps the soil from freezing

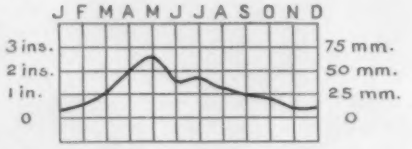

Fig. 10—Eastern Rocky Mountain Foothills type. Mean annual rainfall, 10-15 inches.

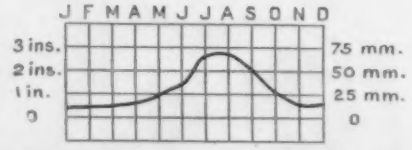

Fig. 11—New Mexican type. Mean annual rainfall, 10-15 inches.

[5] *Op. cit.* in footnote 1.

deeply. In the foothills, the winter winds blow this light snow into the gullies and hollows, leaving much of the open country bare for grazing.

The Missouri type extends well into the climatic province of the Southern Plains, but, as is to be expected, the simple type illustrated in Figure 2 gradually loses its distinguishing character and becomes more complex. Thus, in eastern Colorado, in western Texas, and in Oklahoma, for example, we find many transitional types which show the ear-marks of adjacent rainfall types of different character and often have two maxima. Along the eastern base of the Rocky Mountains, chiefly in the Northern Plains Province but also extending across into the Southern Plains Province, the maximum comes in May (or even April) rather than in June. This may be considered a slight modification of the pure Missouri type and may be called the *Eastern Rocky Mountain Foothills* type (Henry). The curve is shown in Figure 10, and its general location is indicated on the map (Fig. 1).

In the southwestern corner of the Plains Province, in New Mexico, and in extreme western ("Trans-Pecos") Texas, there is a simple rainfall type, illustrated in Figure 11, with a dry winter and a well-marked mid- or late summer rainfall maximum (July-August). This somewhat resembles the Missouri type, but has drier winters and a later maximum. The winters of this type, which we call the *New Mexican*, are dry because the district is well removed from sources of moisture and because it is visited by but few cyclones, of which not many bring precipitation of consequence. The summer rains come in local thunderstorms, which occur with great regularity, frequency, and intensity over the heated mountains and plateaus of this semi-arid area. Most of this summer precipitation is available for crops only indirectly, through irrigation. The rainfall of this type comes mostly in showers of comparatively short duration. Outdoor occupations are thus seldom long interrupted by wet weather.

Rainfall Types of the Plateau Province

The rainfall types of the great inter-mountain Plateau Province are interesting because of their transitional character. As a whole, the dominant characteristic of the rainfall distribution west of the Rocky Mountains is the cold-season maximum (except over the southern portion of the Southern Plateau Province). This is especially marked on the Pacific Slope. The summer maxima east of the Rockies and the winter or spring maxima west of them are found more or less commingled in the Plateau Province. Thus we here find a combination of the marine rainfall régime of the Pacific coast and the continental régime of the interior.

Two well-defined rainfall types may be distinguished, one in the north, the other in the south. The rainfall distribution over the Northern Plateau Province, which may be called the *North Plateau* type, is illustrated in

Figure 12. We have here a winter maximum (December-January), marine in character, and a mid- or late summer minimum (July-August), but there is a distinct increase in the rainfall towards the end of winter, reaching a secondary maximum in late spring (May). This is a continental feature, not found on the narrow Pacific coast. Some stations in this district have one maximum only, in spring, but July and August are the driest months at all the stations. The Missouri, or Eastern Rocky Mountain Foothills type, is sharply separated from the North Plateau type by the Rocky Mountain barrier. The seasonal variation of rainfall is by no means as marked as it is west of the Sierra Nevada-Cascade barrier. These winter rains or snows of the North Plateau type are brought by the general cyclonic storms of the colder months, the moisture coming very largely from the Pacific Ocean. The spring and summer rains are mostly of thunderstorm origin. This North Plateau type of rainfall overlaps somewhat the southern boundary of our Northern Plateau climatic province, being found, as indicated on the map (Fig. 1), in northern Utah and in northern and northwestern Nevada. A few stations in the belt of country fringing the mountains in western Nevada share in the Pacific type of rainfall (see below), which here overlaps the Sierra Nevada from the west. The spring rains of Figure 12 are economically of much importance, either directly, because they fall when the crops are making their early growth, or indirectly, because applied through irrigation. As Messrs. L. J. Briggs and J. O. Belz have pointed out in an interesting report,[6] spring wheat is not successful over much of this region because sowing cannot begin until late on account of the spring rains. Fall-sown wheat, on the other hand, has the benefit of the winter and spring rains and matures before the dry season of July and August. There is so little chance of rain during the "dry" months that grain is often left for days in the open air, piled in sacks, before being taken to storage. The winter snows on the mountains are economically important in maintaining the summer flow of the rivers, which otherwise, in the summer dry season of this province, would then have little or no water.

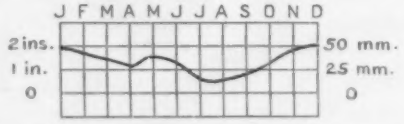

FIG. 12—North Plateau type. Mean annual rainfall, 10-20 inches.

As we progress southward from the Northern Plateau Province into central and southern Nevada and Utah, a gradual change takes place in the rainfall type. In place of the late spring maximum of the North Plateau type, we find a more and more marked late summer (July-August) maximum, with a secondary maximum in winter. The primary minimum comes in spring and early summer (May-June), the secondary minimum in autumn (October-November). Figure 13 illustrates what we have named the *South*

[6] L. J. Briggs and J. O. Belz: Dry Farming in Relation to Rainfall and Evaporation, *Bur. of Plant Industry Bull. No. 188*, U. S. Dept. of Agric., Washington, 1910, 71 pp.

Plateau type. This is a complex curve. It shares in the characteristics of the New Mexican on the east and of the characteristic rainfall distribution of the Pacific Slope on the west. It is on the whole most clearly developed in Arizona, but is found, often with more or less complication, over most of the Southern Plateau Province, including western Colorado and southeastern California. On the higher summits and slopes of the Colorado mountains most of the precipitation occurs in the colder months. States like Nevada and Utah, situated among three or four different rainfall types, naturally show considerable diversity and complexity in their rainfall types. In the South Plateau type, one-third or more of the annual rainfall comes in the months of July and August. The rainy season begins very suddenly, but there is a slow and moderate decrease towards the autumn minimum. The summer rains, which are very persistent, are afternoon or evening thundershowers of local convectional origin, occurring chiefly over the heated mountains and plateaus of this region, but also overlapping, to some extent, the adjacent valleys and plains. There is considerable variation in the annual amount of these rains. This fact suggests some more or less direct cyclonic control which is probably to be found in the permanent "Yuma low" over the lower Colorado. Water vapor from the Gulf of California is brought by the prevailing southerly winds on the eastern side of this low and is condensed as rainfall over the higher elevations. Weak secondary cyclonic depressions, moving eastward from the Yuma low, also seem to contribute a share of this summer rainfall. It is not improbable that the supply of water vapor from the Pacific Ocean is greater in summer than in winter, because the westerly winds are not likely to deposit as much moisture during their passage across the Sierra Nevada in the warmer season. The winter rains are cyclonic. They are more or less sporadic like the summer rains, occur in connection with low-pressure areas, are under the same general control as the winter rains of the Pacific coast, and depend for their intensity, amount, and distribution upon the character, development, and movement of the winter cyclones. The principal rainy season of the South Plateau type comes after the time of maturity of the staple crops, which are here dependent upon irrigation. The cold-season rains help winter pasturage, and the winter snows, where they fall, protect the grass. The snow which forms much of the winter precipitation on the higher mountains is important in maintaining a supply of water for irrigation in the interval before the late summer rains come.

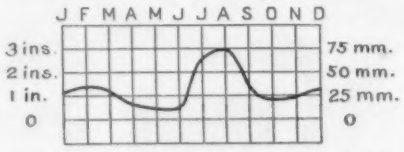

FIG. 13—South Plateau type. Mean annual rainfall, 10-15 inches.

RAINFALL TYPES OF THE PACIFIC PROVINCE

Our Pacific Province (i. e. the Pacific Slope west of the Cascade-Sierra Nevada divide) has well-marked winter rains, with wholly or nearly rain-

less summers. The rainy season usually extends from October or November to March or April. Over much of the area more than one-half of the annual rainfall comes in the period December-February. The rainiest month is generally December. At some southern stations it is February. The control of what has been termed the Pacific type of rainfall is to be found essentially in the equatorward migration of the cyclonic storm belt of the prevailing westerlies with the advance of autumn and winter and in the northward movement of this same storm belt in spring and summer. These are known as subtropical rains. They were first known and studied in the classic Mediterranean region of the Old World. Later they were found, with similar characteristics, in Chile, on our Pacific coast, in southwestern Australia, in South Africa. In Washington and Oregon, and in northernmost California, the winter maximum is due to the fact that the land is then cold and that the westerly winds and their storms are then most active. Light rains from weak cyclonic depressions keep the warmest months from being absolutely dry. Farther south, while local thunderstorms may occur on the mountains in summer, the lower slopes and valleys are practically, or altogether, rainless. Both lowlands and mountains are warm and do not cool the winds as they do in winter. The length and intensity of the dry season increase from north to south. In the San Joaquin Valley, for example, three or four months may be rainless.

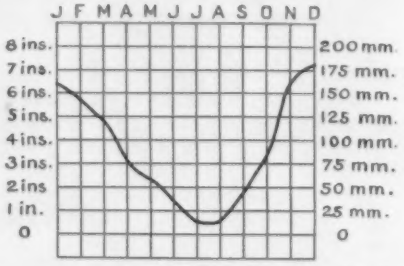

FIG. 14—North Pacific type. Mean annual rainfall, 40-50+ inches.

The essential difference in rainfall type between the northern and the southern sections of our Pacific Province is found in the character of the summer "dry" season, whose control is found in the northward withdrawal of the storm belt and its replacement by the northward extension of the margins of the trade-wind belt. For convenience, the state boundary between Oregon and California may be taken as the line roughly separating these two types of Pacific rainfall, although, as just pointed out, northernmost California is similar in its rainfall type to Oregon and Washington. To the north we have what we may call the *North Pacific* type (Fig. 14), with significant midsummer rains. To the south we have a *South Pacific* type (Fig. 15), extending over 500 or more miles along the coast, with wholly or practically rainless summers. This latter condition is of essential economic importance in making it possible to leave the harvested cereal crops outdoors, uncovered, during their removal to more permanent storage places, and in providing an unusually favorable opportunity for sun-drying fruits like raisins and apricots. On the other hand, the precipitation of the

colder months furnishes moisture for the fall-sown crops, which grow slowly through the winter months and are ready for harvesting at the end of the rainy season. The winter is the season when vegetation is green and fresh. In summer the landscape is brown and gray except where there is irrigation. The snowfall on the higher mountains provides the water necessary for irrigation when the winter rains are over. Afternoon thundershowers and occasional light rains occur in some summers. In California, the rains of April and May are of the greatest value to agriculturists. No matter how abundant the winter precipitation may be, it is the rains of April and May which are the critical ones.

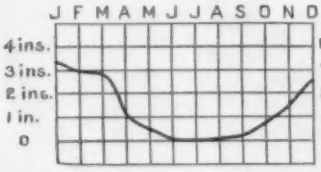

FIG. 15—South Pacific type. Mean annual rainfall, 10-15 inches.

"RAINY SEASONS" IN THE UNITED STATES

It is clear from an examination of the foregoing curves that certain portions of the United States have distinct rainy seasons. Such rainfall types as the Missouri (Fig. 2), the Florida (Fig. 7), the New Mexican (Fig. 11), the Pacific (Fig. 14 and 15), in which there is a well-marked variation in the rainfall during the year, have rainy seasons. On the other hand, obviously, the Ohio (Fig. 3), the Tennessee (Fig. 6), and above all the New England (Fig. 4) types have so uniform a distribution of rainfall that to speak of rainy seasons is out of the question. These conditions of seasonal rainfall have been graphically presented by Professor Mark W. Harrington in a series of four charts of our "rainy seasons."[7] Districts which have equal percentages of their annual rainfall in their "rainy season" are enclosed by lines indicating that from 30 to 40, 50, or even 60 per cent of the annual amount comes in the two or three rainiest months. The area with over 30 per cent in the months of May, June, and July covers the northern and central portions of our Plains Province, reaches into the Upper Lakes region, and extends eastward as an elongated and narrowing zone as far as Pittsburg, Pa. (Missouri type). In the far Northwest, the percentage of rainfall in these three months is 50 per cent of the total. The 30 per cent line for July and August embraces eastern Arizona, practically all of New Mexico, and the western angle of Texas (New Mexican type). Most of this area has over 35 per cent in its rainy season. The 30 per cent line for July, August, and September reaches from Pensacola, Fla., to south of Cape Hatteras and includes Florida (Florida type). On the Pacific coast, with its marked winter maximum, December to February bring over 50 per cent of

[7] Mark W. Harrington: Rainfall and Snow of the United States, Compiled to the End of 1891, With Annual, Seasonal, Monthly and Other Charts, *Weather Bur. Bull. C*, U. S. Dept. of Agric., Washington, 1894. Atlas and text. [Chart 20 and pp. 24-25 concern rainy seasons. The four charts in Bulletin C are combined in one in the Atlas of Meteorology, Pl. 19; text, p. 19.]

the annual rainfall in southwestern Oregon and over all of California except the extreme southeast (Pacific type). These charts show clearly the uniformity of precipitation throughout the year over most of the Eastern Province and the characteristic occurrence of summer rains east of the Rocky Mountains. West of longitude 114° W. over 30 per cent of the yearly rain falls in winter. Harrington has also shown the location of the maxima and the minima of rainfall by means of lines drawn centrally through areas where a maximum or a minimum occurs in any month.[8] The most noteworthy features of these charts are the enormous area, east of the Rocky Mountains, with a June maximum; the extension of the winter maximum from the Pacific Slope inland and eastward generally as far as the continental divide; and the fact that the minimum rainfall area is more extended in winter than at any other season.

General Bibliography

(Specific references are given in the footnotes)

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B. C. Wallis: The Rainfall of the Northeastern United States, *Monthly Weather Rev.*, Vol. 43, 1915, pp. 11-14.

Idem: The Distribution of the Rainfall in the Eastern United States, *ibid.*, pp. 14-24.

Idem: The Distribution of the Rainfall in the Western United States, *ibid.*, pp. 170-175.

Idem: The Rainfall Régime of the Several States, *ibid.*, pp. 176-178.

[Note: In this series of papers the author presents charts showing the rainfall for each month by lines of equal departure from the rainfall norm, or "equipluves." The norm is the amount of rainfall that would occur at any place on the assumption that such rainfall was evenly distributed throughout the year. In other words, the usual *monthly* rainfall averages are expressed as percentages of the *annual* value at each station. This norm is shown by the equipluve of 100. Charts of the wettest and driest months and of rainfall regions are given, as well as diagrams of rainfall intensities.]

Idem: Rainfall and Agriculture in the United States, *ibid.*, pp. 267-274.

Summaries of Climatological Data by Sections, *Weather Bur. Bull. W*, U. S. Dept. of Agric., Washington, D. C., 1914, and later dates. [Text, maps, diagrams.]

[Note: The earlier work of Blodgett, and especially of Schott, contains much that is still of interest and of importance in connection with our rainfall types.]

[8] *Loc. cit.*, Charts 19 and 21; text, pp. 23-25.

GEOGRAPHICAL RECORD

NORTH AMERICA

The Economic Causes of New York's Supremacy as a Port. In the *Greater Port of New York Supplement* of the *New York Evening Post* for June 20, 1917, Professor Emory R. Johnson reviews the economic factors operating in the growth of New York as a port. In 1797, when the exports of New York state first exceeded those of Pennsylvania, New York became the first port of the country. Since that date the state and the city have always occupied the premier position in import trade, and only for a limited period in the thirties and the forties has New York been ousted from the first place in the list of exporting states. The temporary superiority of Louisiana gained by the cotton trade and Mississippi navigation had been eclipsed even before the Civil War created a unique opportunity for the ports of the North. Prior to 1860 New York owed much to her coastwise trade. Primarily this rested on her splendid geographical advantages—an excellent harbor, a central location between the manufacturing Northeast and the agricultural South and a direct water route via the Erie Canal to the West. In 1825 the port registered the arrival of 4,000 coasting vessels against 1,400 from foreign ports.

To New York the Civil War brought a trade increase both absolute and relative. Closure of the Mississippi route turned traffic east via the railroads and the Great Lakes and the Erie Canal and thus concentrated commercial movement on New York to an unprecedented extent. Tonnage on the canal in 1862 was double that in 1859. A part of this remarkable increase, due, as it was, to an outside and temporary cause—grain failures in England—also helped permanently in the consolidation of New York's foreign commerce. Of the entire country's exports in 1860 New York claimed 24 per cent: a decade later the city's share had risen to 50 per cent. Retardation of progress in the South and expansion in the Middle West continued to give the advantage, with few counterbalancing influences.

In recent years, however, a tendency towards decentralization has arisen, and New York's share of both import and export trade has been diminished, the former to about 55 per cent, the latter to 35 per cent, though last year's trade, with its vast export of war material, shows a return to the proportion of three decades ago. At the same time the absolute gains have been large. Even before the war New York had become the greatest world port in respect of tonnage, outranking London in both 1912 and 1913 (compare the article by O. P. Austin in the same issue of the *Evening Post Supplement*). Nor is the city's ultimate supremacy menaced. Diversification and territorial spread of industry and the acquisition of new markets in South America and across the Pacific are offset by certain advantages: superior transportation facilities, a vast reservoir of diversely skilled labor, and the cumulative effects of established financial leadership and commercial organization.

Immigration after the War. In 1914 the surplus of alien immigration over emigration contributed over 900,000 souls to the population of the United States. In 1915 and 1916 combined it has not reached one-third of this figure. The future course of the movement is a matter of interested speculation. To secure a basis of prediction the United States Chamber of Commerce recently sent out a questionnaire to various organizations in close touch with the country's alien and naturalized residents (*Information*, March, 1917, New York). Replies in response to it indicate opinion strongly tending to the belief that immigration will be resumed in volume at the close of the war, though it may be some time before the high pre-war figures are again reached. A large exodus of people going to the relief of distressed relatives is also anticipated, but it is believed that this outward movement will be temporary only.

Rainfall and Agriculture in the United States. One of the papers mentioned by Professor Ward in the bibliography at the end of his article in this number of the *Review* is of special and present interest, as it deals with the relations between agriculture and rainfall in the United States (B. C. Wallis: Rainfall and Agriculture in the United States, *Monthly Weather Rev.*, Vol. 43, 1915, pp. 267-274). The states are grouped, first on the basis of rainfall, secondly, on the basis of agriculture. On the latter basis the groups are named The Cereal States; The Cotton States; The Northeastern States; The Central Eastern States; The West Coast States; The Mountain States. The mixed nomenclature indicates the difficulty of devising a systematic agricultural grouping.

By means of tables the periods of sowing and reaping the principal crops are clearly shown. The shortness of the growing season in the Northern States stands in sharp contrast to the longer season in the South. Many interesting deductions are made, among them: "(1) Harvesting operations do not generally occur in the month of greatest rainfall; (2) Generally the summer crops are sown just preceding the wettest season and the winter crops just following it."

Other sets of tables bring out the comparative production of the principal crops as well as the relation of length of growing season and amount of rainfall to successful crop production. The rank of a state is determined by computing the production of a crop per square mile of the total area. On this basis Indiana is classed as the best winter wheat state in the Union. Another interesting deduction is stated "that the growing period of maize in the cotton states is very prolonged and this should be associated with the very poor yield per acre which is obtained." This statement implies a causal relation which is to be doubted in view of the fact that larger yields per acre of corn have been produced in some of the Southern States than in the states of the corn belt. Although the methods employed of computing agricultural rank of the states and some deductions from the data submitted are open to question, the paper presents much very valuable material. N. A. BENGTSON.

Hail in the United States. As a fitting supplement to recent Weather Bureau work on the origin, mechanism, and distribution of thunderstorms, Professor A. J. Henry has made a study of hail in the United States (*Monthly Weather Rev.*, Vol. 45, 1917, pp. 94-99). The compilation of hail statistics upon which this investigation is based was undertaken because of the immediate necessity for a knowledge of the approximate frequency of hail in this country. An earlier attempt (*ibid.*, Vol. 26, 1898, p. 546) was not wholly successful because the data then available were incomplete. The new chart of annual hail frequency shows that the region of most frequent occurrence (four or more storms a year) is in southeastern Wyoming and eastward therefrom, including the western portions of Kansas, Nebraska, and Oklahoma. Adjoining this region, especially to the eastward, the average number of storms per annum decreases to three over practically all of South Dakota, Nebraska, Kansas, the western and central portions of Iowa, the northwestern third of Missouri, all of Colorado, and the southeastern portion of Wyoming. East of the Mississippi the annual average is two storms a year. A second region of hail frequency is found in southwestern Montana and southern Idaho and the mountain districts of New Mexico and northern Arizona.

Hail is in general a phenomenon of the warm season. The only notable exception is the immediate Pacific Coast from San Francisco northward. There hail occurs chiefly in November to March. In the warm season, hail is closely associated with thunderstorms and tornadic phenomena. Practically no damage to agricultural crops by hail is possible in the Pacific Coast States, and only small damage is possible in the Gulf States, both by reason of the infrequency of the phenomenon and the absence of crops at the time of greatest frequency. One hail insurance company in Iowa has, during the last twenty-four years, paid on an average $77,525 a year for hail losses. Professor Henry's paper is illustrated by means of five charts, showing the average number of days with hail, by seasons and for the year, for 1906-1915. R. DEC. WARD.

East Indians in the West Indies. It is not perhaps generally appreciated that to the already mixed racial composition of the West Indies a new element is steadily being added. For some years past in fact the increase of population in Trinidad and British Guiana has been due almost entirely to immigration from India. In British Guiana the census of 1911 showed 126,517 of East Indian origin out of a total of 296,041. Trinidad, with a total population of 333,552, numbered 108,606 of the same origin, and in other islands the proportion of this element is increasing to a degree whereby it promises to hold the majority at some time in the future. Practically all the East Indians come out under contract with the West Indian governments as indentured laborers to work on the sugar and cacao plantations. Their contracts bind them for five years, but they are also required to remain in the colonies for another five, during which they are free to take up land or to work for whom they please. As a body they have gained a reputation for hard work and thrift. During the period of indenture many of them save enough money to purchase land, and the number of land owners among them grows steadily. The common procedure is to buy a few acres of forest land from the government, clear it and plant it with cacao or coconut trees, utilizing the space between the trees for "ground provisions." When the trees begin to bear, in five or six years time, his little property assures the owner an independence (Watson Griffin: Canada and the British West Indies: Report on the Possibilities of Trade under the Preferential Agreement, Chapter 8, Department of Trade and Commerce, Ottawa, 1915).

An Eruption of Poás Volcano, Costa Rica. C. T. Mason publishes in *Dun's Review (International Edition)* for January, 1917, a set of five photographs illustrating an eruption of Poás volcano, a phenomenon whose occurrence has been seldom recorded. Poás volcano (8,785 feet in elevation) occupies a central location in the volcanic chain of northern Costa Rica. The active crater, a large circular basin, holds a lake of turbid green water of high temperature and strongly sulphuric. The ordinarily placid surface of the water is disturbed at irregular intervals by geyser eruptions of varying degrees of intensity. According to Pittier (Kostarika: Beiträge zur Orographie und Hydrographie, *Petermanns Mitt. Ergänzungsheft No. 175*, pp. 13-14, 1912), the column of water thrown into the air during an eruption of 1888 only reached a height of 6 to 9 feet, while during a period of seismic activity in the succeeding year he himself witnessed an eruption in which the column ascended to 230 feet and lasted for 15 to 19 minutes. (For an account of the volcano and its activities see also Karl Sapper: Die mittelamerikanischen Vulkane, *Petermanns Mitt. Ergänzungsheft No. 178*, pp. 112-117, 1913; for a description of a visit after the eruption of 1910 see A. S. and P. P. Calvert: A Year of Costa Rican Natural History, New York, 1917.)

At present access to Poás volcano is difficult, but a road 30 miles long would put it into communication with San José and open up a district with considerable possibilities as a tourist and health resort.

EUROPE

Audibility of Gun-Firing Over the Southeast of England. Messrs. Miller Christy and William Marriott have investigated the audibility, in England, of the gun-firing in Flanders, and also the meteorological conditions under which the firing was heard (*Quart. Journ. Roy. Meteorol. Soc.*, 1916, pp. 267-285). The observations were made in Essex County, in southeastern England, about 125 miles northwest from Ypres, that being taken as a fairly central point in Flanders around which there has been exceptionally severe land fighting. The point of observation was about 155 feet above sea level, without any higher ground in the immediate vicinity. In fact, there is no higher ground between this point and Ypres. The observations were continued during a period of eight months. The maximum distances at which the firing has been heard seem to be about 220 miles from the firing line, during the great British "push" in July, 1916, and about 300 miles on two other occasions, once during the naval battle in the North Sea, January 24, 1915, and again at the time of the naval battle off Jutland Bank, May 31, 1916.

A study of the meteorological conditions shows that gun-firing was most frequently heard where there was a light or moderate breeze blowing between north and east and when the sky was cloudy or overcast. The most favorable pressure conditions are those when there are irregular or poorly defined areas of relatively low pressure with a slight elevation of pressure between them. Calms or light airs then prevail at the surface, while the upper currents may be moving faster than the lower and from a slightly different direction. Under these conditions the sound waves are probably refracted in the upper currents and reflected downwards to great distances. The popular superstition that heavy gun-firing brings rain may possibly have its source in the fact that conditions favorable for audibility are also conditions favorable for heavy rains of a thunderstorm type.

R. DEC. WARD.

The Project of Draining the Zuider Zee. In January, 1916, North Holland suffered a flood disaster from the Zuider Zee said to be the worst on record since 1825. The catastrophe greatly revived interest in the ancient, much discussed project of draining the waters of the inland sea, and now a bill for the purpose has been introduced before the Netherlands Parliament. The project calls for the construction of a dam from the northern end of the province of North Holland via the island of Wieringen to the coast of Friesland. Including the island, the length of the proposed dam will be 24 miles: it will cut off 882,000 acres of the upper waters of the Zuider Zee and of these it is proposed to drain some 500,000. The time required for complete execution of the undertaking is estimated at fifteen years and the cost of the dam, drainage, and various protective works is placed at $90,000,000. The measure is complicated by the number of diverse interests involved. Among other considerations it must take into account indemnification of the fishing and shipping activities that will suffer thereby (*Commerce Repts.*, Jan. 19, March 30, Oct. 11, 1916, and March 9, 1917).

ASIA

Completion of the Amur Railroad. Passengers from Vladivostok to western Russia need no longer make use of the Chinese Eastern Railway section of the Trans-Siberian line: the all-Russian route has now been completed by the opening, in October, 1916, of

the Kabarovsk bridge (*China Maritime Customs Statist. Series Nos. 3 to 5 (Returns of Trade and Trade Repts.)*, 1916, Part 2, Vol. 1, Shanghai, 1917, p. 8). This great bridge, one of the longest in the world (8,523 feet), crosses the Amur where the railroad turns south to leave the basin for Vladivostok (compare note on "Siberian Traffic Problems," *Geogr. Rev.*, Vol. 1, 1916, p. 461).

A Flood Survey of the West River in Southern China. The Canton delta and the lower Si-kiang, or West River, in southern China were the scene of disastrous floods in June, 1914. At Wuchow the waters rose 22 feet in twenty-four hours. A year later a survey was undertaken for the regulation of the river, particular attention being paid to the region between Wuchow and the sea. Parts of the report submitted by the chief engineer, Captain G. W. Olivecrona of the Swedish army, to the Board of Conservancy Works at Kwantung, are reprinted in the April, 1917, issue of the *Far Eastern Review* (pp. 413-417). This account is of interest because the occasion was the first on which the hydrography of the region was systematically investigated by a staff of foreign engineers.

Rising in eastern Yunnan, the West River first flows south, receiving additional waters from rivers originating in the lakes of the Yunnan plateau, and then northeast, to the meeting point of the boundaries of Yunnan, Kweichow, and Kwangsi. Down to this point it is known as the Pa-ta-ho. From here it flows east along the frontier between Kweichow and Kwangsi and then southeast and east-southeast across Kwangsi province to Sünchow (110° E.), during which part of its course it is called Hungshui, which means "red water," from the color of its silt. Finally in its lower course it becomes the Si-kiang, reaching the sea in four branches known as Junk Fleet, Motomoon, Futinmoon, and Ngaemoon. Except in its last stretches and for a distance of about 90 miles above its mouth the river and its tributaries flow through rugged country. Its drainage basin covers an area of 130,000 square miles.

Of the tributaries, the Liu Kiang is the largest on the left. Its width and depth at the point of confluence are greater than those of the Hungshui, and for this reason it has sometimes been mistaken for the main river. But in the opinion of the surveying commission, the Liu Kiang is to be considered as a tributary, albeit the larger, because the length and the drainage basin of the Hungshui are greater. Another important left tributary is the Pepan-kiang. The major right affluent is the Yu-kiang, which joins the West River at Sünchow; it is navigable to Nanning (108° E.) all the year for shallow-going motor-boats and junks and for nine months as far as Poseh (106° E.).

To prevent flooding of the low country the commission recommended that the present dyke system be improved by additional construction and that the dykes be maintained to a sufficient elevation. Much of the economic prosperity of the Canton delta depends on the control of the rivers which reach it. The upper reaches of the affluents of the West River are subject to heavy rain storms which cause great accumulation of water. To regulate this excess is the problem which the Board of Conservancy Works at Kwantung is trying to solve and for which the surveying and hydrographical observation work was carried on.

The Proposed Indo-Ceylon Railway. A continuous railway net extending from north of the Arctic Circle (Narvik, 68½° N.) to within six degrees of the equator (Pointe de Galle) may become an accomplished fact if, in addition to the proposed connection of the European and Indian railway systems, discussed in Mr. Baker's article in this number of the *Review*, the projected linking of Ceylon with the Indian mainland is carried out (*Engin. Suppl. of the London Times*, Jan. 26, 1917, p. 35, based on a paper by F. J. Waring before the Institution of Civil Engineers). Recent extension of the South Indian Railway to the eastern point of Rameswaram Island and of the Ceylon Railway to the western point of Mannar Island leaves between the two systems a gap of little more than twenty miles. The possibility of closing the gap is suggested by the existence of the well-known Adam's Bridge. Superficially the bridge is of sand, in part above water level and for a portion of its length overlying rock at no great depth. It divides the shallow channel of Palk Strait from the comparatively deep Gulf of Mannar. Water levels in the two channels vary according to the action of the strong, steady monsoon winds which blow alternately in opposite directions against the bridge. In conjunction with the asynchronous tides a maximum difference of 18 inches is established between the levels on either side of the bridge. The action of the local currents thus set up is complicated, and the railroad engineer has to face an interesting problem.

HUMAN GEOGRAPHY

Telephone and Telegraph Development as an Index of National Culture. Civilization advances by the interchange of products—material and spiritual. Measure-

ments of the degree of or facility for interchange are indices of civilization. In a suggestive paper, "The Culture of the Nations" (*Bull. Amer. Geogr. Soc.*, Vol. 43, 1911), Jefferson selected four such indices to arrive at an estimate of world civilization, and on its basis he classified 69 countries into four cultural classes. The indices were schooling, commerce, development of railways, and use of the mail. With his conclusions, though based on statistics of earlier date, the latest available telephone statistics make interesting comparison (Telephone and Telegraph Statistics of the World, January 1, 1914, Amer. Telephone and Telegraph Company, New York City).

The fifteen countries ranked by Jefferson in the highest class all have a comparatively highly developed use of the telephone. All have 50 or more telephones to 10,000 population and most of them have over 150. Countries of the lowest culture, including all Africa except Egypt and the Union of South Africa and Asia except Japan and Asiatic Russia, have only 2 or less telephones per 10,000 inhabitants. Telephony also has made little headway in South American countries falling in the lowest rank—Bolivia, Peru, and Colombia with 10 per 10,000. At the other end of the scale in South America are Argentina and Uruguay. Uruguay has 100 telephones per 10,000 population, Argentina 90. In these two countries, unlike the remainder of the continent, the pure Indian element is practically non-existent.

Of greatest interest is the telephone distribution in the countries of the first rank. Most striking is the leadership of the United States, where internal commercial movement is also great. The United States has 970 telephones to the population unit. Canada is second with 650. Distribution in these countries may well be compared with Huntington's maps of the distribution of civilization and of human energy on the basis of climate ("Civilization and Climate," New Haven, 1915, p. 200). The first practical telephone was an American invention.

Besides Canada other British colonies with responsible government make a good showing in telephone usage. In these new countries, where other means of communication are not yet well developed, the telephone and telegraph assume special importance. The latter in particular figures with a high proportional development where there are great areas scantily populated. In this relative development of the telegraph Canada leads with 250 miles of wire to 10,000 population; New Zealand has 240 miles and Australia 220. The United States has 190 miles and Argentina, where the progress of colonization bears many resemblances to that of the Anglo-Saxon type, has 160 miles per population unit. All greatly exceed figures in Europe.

Turning to telephone statistics in Europe we find a surprisingly high development in the Scandinavian countries. Denmark has 450 telephones per 10,000 people; Sweden 410, Norway 340. Here are countries which are adapted both through race and geographic position to very high cultural rank. In Jefferson's scale, however, Norway and Sweden appear at the end of the first class. This is largely due to the comparatively feeble development of their railways, itself attributable to difficult physical conditions. On the contrary an enterprising and well-educated people is ready to take advantage of an appropriate means of communication. The progress of telephony has been closely followed by the Scandinavian countries. For several years Stockholm has led the world's cities in the number of telephones per capita: today the number per 10,000 population is 2,410, where for the twelve largest cities of the United States it is 1,130. In proportion to the figures for these northern countries the number for France, 80 per 10,000, seems remarkably low. Here, however, as in Great Britain, the employment of telephone service met considerable opposition from the well-developed telegraph systems. In France there is a higher proportional development of the latter than in any other European country.

GEOGRAPHICAL NEWS

Meteorological Bibliography. Those who need to use current meteorological bibliographies will be interested to know that a change has been made in the bibliography regularly published in the *Quarterly Journal of the Royal Meteorological Society*. Beginning with the issue for January, 1917, the subject-headings and numbers used in the "International Catalogue of Scientific Literature" have been adopted. This is a distinct improvement over the method previously followed in this publication, which was purely alphabetical.

R. DEC. WARD.

OBITUARY

DR. ROBERT BELL, associated with the Geological Survey of Canada since 1857 and its director from 1901 to 1906, died on June 18 at Rathwell, Manitoba, in his seventy-sixth year. For a period of over forty years he was actively engaged in the geological

exploration of Canada. His work dealt mainly with the Laurentian Plateau, that vast area of archaic rocks which surrounds Hudson Bay in the form of a horseshoe. The extent and wide distribution of the areas he examined, together with his habit of describing the broad, general features of a region, impart a high geographical value to his publications. The most important among these are: On the Geology of the Northwest Coast of Lake Superior and of the Nipigon District, *Rept. of Progress of the Geological Survey of Canada for 1866-69*, pp. 313-364, with a map, 1:253,440, embodying an original survey of Lake Nipigon; Report on an Exploration between James Bay and Lakes Superior and Huron, *ibid. for 1875-76*, pp. 294-342; Report on an Exploration of the East Coast of Hudson Bay, *ibid. for 1877-78*, pp. 1C-37C, with map, 1:253,440; Report on the Country between Lake Winnipeg and Hudson Bay, *ibid.*, pp. 1CC-31CC, with a map of the Nelson River, 1:506,880; Report on Explorations of the Churchill and Nelson Rivers, *ibid. for 1878-79*, pp. 1C-44C; Report on Hudson Bay and Some of the Lakes and Rivers Lying to the West of It, *ibid. for 1879-80*, pp. 1C-113C; Observations on the Geology, Mineralogy, Zoology, and Botany of Hudson Strait and Bay, *Annual Rept. Geol. Survey of Canada*, N. S., Vol. 1, 1885, pp. 1DD-20DD; Report of an Exploration of the Northern Side of Hudson Strait, *ibid.*, Vol. 11, 1898, pp. 1M-38M, with map of the coasts of Hudson Strait and Ungava Bay (with A. P. Low), 1:1,584,000. In the report for 1879-80 occurs a section on "The Northern Limits of the Principal Forest Trees of Canada East of the Rocky Mountains," with a map 1:5,068,800, a topic also treated in the article "The Geographical Distribution of Forest Trees in Canada," *Scott. Geogr. Mag.*, Vol. 13, 1897, pp. 281-296. A comprehensive paper on "The Labrador Peninsula" appeared in the same journal, Vol. 11, 1895, pp. 335-361. Dr. Bell's advocacy of the Hudson Bay route, based on his personal knowledge of conditions, is embodied in two papers read before the Geographical Section of the British Association for the Advancement of Science (reports, York meeting, 1881, p. 745, and Winnipeg meeting, 1909, p. 529), and in a pamphlet entitled "A New Route to Europe from the Interior of British North America," Montreal, 1881. The present consummation of this project was described by Mr. J. H. Cormie in the July number of the *Review* (pp. 26-40). Readers of Mr. F. J. Alcock's article on the Churchill River in the December, 1916, *Review*, will find pictures of the ruined Fort Prince of Wales, there described, in Dr. Bell's report for 1879-80. In 1907 Dr. Bell was awarded the Cullum Geographical Medal of this Society.

Dr. Arnold Hague, the well-known geologist, died in Washington, D. C., on May 13, aged 77 years. During the early part of his career Dr. Hague was attached to the Fortieth Parallel Survey under Clarence King. With S. F. Emmons he contributed Volume 2 (Descriptive Geology, 1877) of the Final Reports. This and the accompanying volume on systematic geology by Clarence King have been referred to by De Margerie as still being the only work containing a connected discussion of Western tectonics (*Mem. Vol. Transcont. Exc. of 1912 of Amer. Geogr. Soc.*, 1915, p. 112). Other major works by Hague are: Geology of the Eureka District, Nevada, with an atlas, *U. S. Geol. Surv. Monogr. 20*, 1892, and, with others, Descriptive Geology, etc., of Yellowstone National Park, with atlas, *U. S. Geol. Surv. Monogr. 32*, Part II, 1899. A popular account appeared from his pen in 1912 (Dept. of the Interior) entitled "Geological History of the Yellowstone National Park."

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

General

MUIR, JOHN. **A thousand-mile walk to the Gulf.** Edited by W. F. Badè. xxvii and 220 pp.; map, ills., index. Houghton Mifflin Co., Boston and New York, 1916. $2.50. 8½ x 6.

In these days when travelers are many, keen observers of nature few, and naturalists almost unknown, it is a keen delight to read and be inspired by the best that John Muir has written. A man of the wild, and yet a lover of domesticity, a philosopher who saw good in all things, with a vision beyond the ability of most men, interested in every nature story and yet primarily a botanist, John Muir gathered widely and carefully as he traveled. In the notebook paragraphs that have been edited into this very readable book, we have much of botany, more of men and places, and an occasional glimpse of a geographic observation far ahead of the times.

The South in the late sixties is presented as it was, and not as it seemed to be to an unsympathetic traveler along its railroads.

John Muir saw and appreciated, wrote down his observations and impressions, allowed himself to wander far into the unknown, earthly and spiritual, and recorded his visions. Out of his notes has been made a book that shows John Muir less mature than he is seen in his "Mountains of California," but just as appealing and inspiring. The volume is interesting and helpful. It should be in the library of every person who would like to be a naturalist if opportunity permitted. RICHARD ELWOOD DODGE.

SCHMIDT, L. B. **The economic history of American agriculture as a field for study.** *Mississippi Valley Hist. Rev.*, Vol. 3, 1916, No. 1, pp. 39-49.

A plea for more attention to agriculture in the study of American history which will be endorsed by geographers if for no other reason because agriculture is so intimately associated with geography. The author holds that the present trend of history, especially American history, "has led students to search beneath the surface of passing events and to study the . . . common everyday life of humanity . . . in its economic, social, religious, political, military, esthetic, and intellectual phases."

The majority of our people, he states, have always been engaged in agriculture, and our history from the beginning has been a story of rural communities advancing westward and developing from simple to complex stages of civilization. The interstate commerce act of 1887 and the Sherman anti-trust act of 1890 show distinct farmers' influence. The purchase of Louisiana was a direct response to the demand of agricultural interests for an outlet along the Mississippi. The close connection of cotton and slavery affected our history from the adoption of the constitution down to the Civil War. England's attitude during the Civil War was influenced by her need of cotton from the South for her mills and the need of wheat from the North to feed her people. Agriculture is passing from the extensive to the intensive state, and this transition will affect our history.

These and other cases cited all show an interplay of geographic factors. Soils, climate, topography, drainage, and other earth factors profoundly affect agriculture and, indeed, may be said to be fundamental. Although the author does not stress the geographic factors, it is clear that this trend in the study of economic history should have a geographic background. F. V. EMERSON.

—— **Foreign commerce and navigation of the United States for the year ending June 30, 1915.** xlv and 928 pp. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C., 1916.

—— **Prairie vegetation, some recent descriptions of.** *Journ. of Ecology*, Vol. 4, 1916, No. 1, pp. 45-54. [A review of A. G. Vestal's "Prairie Vegetation of a Mountain-Front Area in Colorado," *Botan. Gaz.*, Vol. 58, 1914, pp. 377-400, and "A Black-Soil

Prairie Station in North-eastern Illinois,'' *Bull. Torrey Botan. Club*, Vol. 41, 1914, pp. 351-363; R. J. Pool's ''A Study of the Vegetation of the Sandhills of Nebraska,'' *Minnesota Botan. Studies*, Vol. 4, 1914, pp. 189-312, and ''Invasion of a Prairie Grove,'' *Proc. Amer. Forestry Assoc.*, Vol. 10, 1915, pp. 1-8; and J. E. Weaver's ''A Study of the Root-Systems of Prairie Plants in South-eastern Washington,'' *Plant World*, Vol. 18, 1915, pp. 227-248.]

PRATT, E. E. **Our new industries: Some of the fields into which American manufacturers have been forced.** Ills. *Scientific American*, Vol. 114, 1916, No. 23, pp. 586, 600-602. [Amongst the industries cited may be noted that of the dressing and dyeing of furs. The United States, the largest producer of raw sealskins, has heretofore sent the raw product to London. Even before the war endeavors were being made to establish the industry in St. Louis. The Federal Government selected this city as a market for its catch of Alaskan seal and blue and white fox furs.]

—— **Proceedings of the fourth American Road Congress under auspices of American Highway Association, American Automobile Association.** 361 pp. Atlanta, Ga., 1914. $1.00. 9 x 6.

QUAIFE, M. M., edit. **Extracts from Capt. McKay's journal—and others.** Diagr. *Proc. State Hist. Soc. of Wisconsin at its Sixty-Third Annual Meeting held October 21, 1915*, pp. 186-210. Madison, 1916. [The journal was recently discovered with that of Ordway and other Lewis and Clark records (cf. A. H. Abel: A New Lewis and Clark Map, *Geogr. Review*, Vol. 1, 1916, pp. 329-345). It was apparently drawn up expressly for the great expedition. Useful information was transcribed from the journals of McKay and his lieutenant John Evans and the transcription annotated by John Hay, a leading British fur trader of Cahokia. To it he added pertinent geographical material amassed during his own travels.]

—— **Quicksilver output in the United States, 1915.** *Mining and Engineering World*, Vol. 44, 1916, No. 6, p. 273.

—— **Reclaiming swamp lands by modern methods.** Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 4, pp. 44-46.

RECORD, S. J. **Our present and future sources of vegetable tannins: Where the American tanner may hope to find an independent supply of raw materials.** Ills. *Scientific American*, Vol. 114, 1916, No. 23, pp. 580-581 and 603-604. [''The tanners and dyers of the United States use annually about $25,000,000 worth of vegetable tanning materials, of which nearly one-third is imported.'']

REDFIELD, W. C. **Remarks. [Relation of our waterways to commerce.]** *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 183-190. Philadelphia, 1915.

REED, S. M. **British cartography of the Mississippi Valley in the eighteenth century.** *Mississippi Valley Hist. Rev.*, Vol. 2, 1915, No. 2, pp. 213-224.

REYNEN, W. B. **De beetwortelsuiker-industrie in de Vereenigde Staten en hare vooruitzichten.** *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 5, pp. 209-221. [''The beet-sugar industry in the United States and its prospects.'']

SAULSBURY, WILLARD. **The strategic value of inland waterways.** Map. *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 95-112. Philadelphia, 1915.

SELLS, CATO. **Report of the Commissioner of Indian Affairs to the Secretary of the Interior for the fiscal year ended June 30, 1916.** iii and 211 pp.; map, index. Dept. of the Interior, Washington, D. C., 1916.

—— **Silver production in the United States in 1915.** Diagr. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 240-241.

SMITH, H. M. **America's surpassing fisheries.** Diagr., ills. *Natl. Geogr. Mag.*, Vol. 29, 1916, No. 6, pp. 546-583.

SMITH, J. W. **National weather and crop bulletin No. 30: October, 1916.** 8 pp.; maps. Weather Bureau, Washington, D. C.

SNOWDEN, THOMAS. **Annual report of the Hydrographic Office for the fiscal year 1916.** 32 pp. *Ann. Rept. of the Chief of the Bur. of Navigation, Appendix No. 1.* Washington, D. C., 1916.

SORRELL, L. C. **Dislocations in the foreign trade of the United States resulting from the European war.** Diagrs. *Journ. of Polit. Econ.*, Vol. 24, 1916, No. 1, pp. 25-75.

STUDY CLUB DEPARTMENT, WISCONSIN LIBRARY COMMISSION. **Present day indus-**

tries in the United States. 6 pp. (Study Outline Ser.) H. W. Wilson Co., White Plains, N. Y., and New York City, 1915. 15 cents. 8 x 5.

TABER, STEPHEN. **The earthquake in the southern Appalachians, February 21, 1916.** Map. *Bull. Seismological Soc. of America*, Vol. 6, 1916, No. 4, pp. 218-226.

TALBOT, WINTHROP. **Adult illiteracy.** 90 pp.; map, diagrs. *Bur. of Education Bull., 1916, No. 35.* Dept. of the Interior, Washington, D. C., 1916. [Distributionary study.]

TALBOT, WINTHROP. **The American illiterate.** Map, diagrs. *World's Work*, Vol. 32, 1916, No. 3, pp. 303-305. [With a map showing the states where illiteracy—due to foreign immigration—is increasing.]

—— **Tin industry and consumption in 1915.** Diagr. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 277-278.

TOMKINS, CALVIN. **Free ports.** *Proc. and Papers of the Fourth Ann. Convention of the Amer. Assoc. of Port Authorities*, 1915, Sept. 13-15, pp. 164-172. Los Angeles, Cal.

—— **Traffic routes from the Lakes to the seaboard.** Map. *Engineering News*, Vol. 76, 1916, No. 13, Sept. 28, pp. 604-605.

—— **United States Coast and Geodetic Survey, Annual report of the Superintendent, to the Secretary of Commerce, for the fiscal year ended June 30, 1916.** 164 pp.; maps, diagrs., ills., index. U. S. Coast and Geodetic Survey, Washington, D. C., 1916.

—— **United States military reservations, national cemeteries, and military parks: Title, jurisdiction, etc.** Revised edit. 544 pp. War Dept., Washington, D. C., 1916.

VOGT, P. L. **The land problem and rural welfare.** *Amer. Economic Rev.*, Vol. 7, 1917, No. 1, Suppl., pp. 91-114 (discussion, pp. 102-114). [Size of holdings and relation of ownership to operation in the United States.]

WARD, R. DEC. **Immigration and the war.** *Scientific Monthly*, Vol. 2, 1916, No. 5, pp. 438-452.

WEST, H. L. **Waterways and our national security.** *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 191-196. Philadelphia, 1915.

WHITHAM, P. P. **Port terminal development: A discussion of fundamental problems.** *Proc. and Papers of the Fourth Ann. Convention of the Amer. Assoc. of Port Authorities*, 1915, Sept. 13-15, pp. 121-138. Los Angeles, Cal.

WICKS, MOYE. **Deforestation and reforestation as affecting climate, rain, and production.** 11 pp. *Texas Dept. of Agric. Bull. No. 17, N. S.* Austin [1916].

WOEHLKE, W. V. **The greatest mining boom in history.** Ill. *Amer. Review of Reviews*, Vol. 54, 1916, No. 4, pp. 429-432. [The present boom in American mining consequent on the European war.]

WOODHOUSE, HENRY. **Post Office Department invites proposals for carrying mails by aëroplane.** Map, ills. *Flying*, Vol. 5, 1916, No. 2, pp. 53-63.

—— ***United States, including Territories and Insular Possessions, showing the extent of public surveys; Indian, military and forest reservations; railroads, canals, National Parks and other details.*** 1 in. to 37 mi. (1:2,344,320). Dept. of Interior, General Land Office, Washington, D. C., 1916. [A new edition of the general map of the United States issued by the General Land Office. It is mainly locational and administrative in character.]

SOUTH AMERICA

ECUADOR, PERU, BOLIVIA

GONZÁLEZ PALENCIA, C. A. **Descripción geográfica de la Real Audiencia de Quito que escribió Dionisio de Alsedo y Herrera.** XXXV and 101 pp., map, index. Publication of The Hispanic Society of America. Imprenta de Fortanet, Madrid, 1915. 10½ x 7½.

Long years of intelligent and devoted service in colonial Spain confer a high value on Alsedo's contributions to the literature of the Indies. His earlier works, the "Memorial Informativo del Comercio del Perú" and the "Aviso Histórico," show a keen appreciation of the dangers threatening the colonies in the first half of the eighteenth century. He fully realized the menace of the Dutch and English and especially the

encroachments of the latter since the grant of the Asiento of 1713. The special knowledge he held led to his appointment as President, Governor and Captain-General of Tierra Firme during a period of English aggression in Panama. He had also been active while President of Quito in repelling Portuguese advances up the Napo. His jealous care had even been carried so far as to endeavor to limit the investigations of the expedition despatched by the French Academy of Sciences to Ecuador for the measurement of an arc of the meridian. He opposed, as he himself expressed it, the projects "poner los ojos en la tierra," though his more tolerant successor permitted the construction of maps and plans. Whilst his career in the Indies terminated in the common fashion with impeachment he was honorably acquitted. His succeeding retirement in Spain afforded him the opportunity of writing (1766) the Descripción Geográfica, a work for which he was specially qualified by experience gained during office as President of the Audiencia.

This work has heretofore been known only from two manuscript copies existing in the National Library of Madrid. It is now published, annotated and with a prefatory biography of the writer. Alsedo's text commences with a description of the city of Quito, "the evergreen," and subsequently takes up the component provinces of the Audiencia, concluding with a short report on the Marañon and Amazonas accompanied by the map of Padre Samuel Fritz published in Quito 1707. Of the entire work perhaps the most particular interest attaches to the chapter on the roads leading to Quito. It is a graphic account of the immense difficulties of communication that isolated Quito until the coming of the railroad. Orton, writing of Quito in 1868 and emphasizing the lack of transportation facilites, remarked: "There are not six carts in Quito. If you wish to move you must coax a dozen Indians, who care little for your money or your threats. Carriages—antique vehicles, of which there are two or three in the city—are drawn by mules. The first was introduced . . . so late as 1859" (Orton: The Andes and the Amazon, New York, 1876.) The editor of the Descripción claims, with justification, that it is the best description of Quito written up to its own date. It is, however, singular that whilst referring to the description of Quijos by the Conde de Lemos (1608) and to other later works he should entirely overlook the valuable material on the Audiencia of Quito contained in the "Relaciones Geográficas de Indias" (Madrid, 1881-97). The third value of that notable collection includes several official reports of the province of Quito and its chief cities written in the last half of the sixteenth century, as, for example, the "Relación de la Provincia de Quito y Distrito de su Audiencia por los Oficiales de la Real Hacienda," dated 1576.

EUROPE

The Low Countries, Luxemburg

Baren, J. van. **Oudere en jongere Löss in Nederland.** Ills. *Tijdschr. Kon. Nederl. Aardrijk. Genoot.*, Vol. 33, 1916, No. 2, pp. 201-205.

Bijlsma, D. **De zuidnederlandsche immigranten en de textielindustrie in oud-Rotterdam.** *Vragen van den Dag*, Vol. 31, 1916, No. 11, pp. 858-867. Amsterdam.

Blink, H. **De loop van den Nederlandschen handel en van de handelsbetrekkingen van Nederland met de belangrijkste landen sedert 1847.** *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 1, pp. 27-37; No. 2, pp. 49-64; No. 3, pp. 107-117; No. 4, pp. 157-160.

Blink, H. **Economische geographie der Provincie Overijsel.** Maps. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 3, pp. 117-128; No. 8, pp. 395-404; **De economische ontwikkeling van Overijsel in de laatste eeuw,** No. 9, pp. 427-441; **Ontwikkeling der nederzettingen in Overijsel als economische centra,** No. 10, pp. 478-490.

Blink, H. **Het hoogheemraadschap Waterland in zijn opkomst, strijd tegen het water en tegenwoordigen toestand.** Map. *Vragen van den Dag*, Vol. 31, 1916, No. 4, pp. 278-297. Amsterdam. [On the district of Waterland on the Zuider Zee near Amsterdam and its perennial conflict against the encroachment of the sea.]

Blink, H. **Nederland als tuinbouwland. Historisch en economisch-geographisch beschreven.** Maps, diagrs., ills. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 6, pp. 229-362.

Blink, H. **Ontwikkeling van de economische toestanden in Nederland en zijn betrekkingen met de nabuurlanden gedurende de laatste eeuw.** *Tijdschr. voor Econ. Geogr.*, Vol. 5, 1914, No. 9, pp. 345-353; No. 10, pp. 369-384; No. 11, pp. 416-434; Vol. 6, 1915, No. 7, pp. 266-276; No. 8, pp. 289-299; No. 9, pp. 329-344.

DUBOIS, EUG. **Hollands duin als natuurlijke zeewering en de tijd.** *Tijdschr. Kon. Nederl. Aardrijk. Genoot.*, Vol. 33, 1916, No. 3a, pp. 395-415.

FOUCHIER, C. AND L. DE. **Au pays hollandais.** 228 pp.; map, ills. Hachette et Cie., Paris, 1913. Fr. 4. 7½ x 5.

GUÉNOT, M. S. **La Belgique pittoresque et les villes martyres: La cité de Gand en 1912; la Belgique terre d'expériences sociales.** *Bull. Soc. de Géogr. de Toulouse*, Vol. 34, 1915, No. 3-4, pp. 212-223.

KIEHL, W. J. L. **Holland in the grip of its old enemy.** Ills. *Scientific American*, Vol. 114, 1916, March 4, pp. 235 and 264. [The storms of Dec. 1915-Jan. 1916 caused undoubtedly the worst flood disaster in Holland since 1825 and in some respects the worst since the famous fifteenth century catastrophe. The waters covered an area of 37,000 acres and have impregnated the land with salt (cf. daily *Commerce Reports*, 1916, No. 42, Washington).]

SCANDINAVIA, INCLUDING FINLAND

SANDSTRÖM, J. W. **Über die Ablenkung des Windes infolge der Erddrehung und der Reibung.** Map, diagrs. *Arkiv för Matematik, Astronomi, och Fysik*, Vol. 9, No. 31, pp. 1-8. Upsala, 1914.

In this paper the author considers an interesting case of frequent left-handed deflection of the wind from the pressure-gradient during the winter on the western slope of the Scandinavian mountains. It appears that there is a well-marked "aspiration" of air towards the Atlantic Gulf Stream area, evidenced by prevailing easterly winds on the western side of the highland. The cold air becomes more or less stagnant, i. e., is blocked, on the eastern side of the divide, and then comes down on the western slopes almost like a waterfall. Near the surface this off-shore air movement is greatly retarded by friction, whereas the upper air moves northwestward at high velocities almost independently of friction. The right-handed deflective force of the earth's rotation, which is proportional to the velocity, is far more effective in the case of the upper than in that of the lower currents. The local topography is very marked, with a system of deep valleys leading from the mountain ridge to the ocean. In each valley the upper air, moving northwest, exerts a strong pressure towards the *right* sides of the valleys. The pressure thus becomes higher here than along the left-hand side of the valley at the same level. This pressure-gradient to the left acts upon the lower air, which is moving at a much slower velocity, and as this same lower air is but slightly affected by the earth's rotation, the result is a left-handed deflection. It is, of course, these lower currents whose direction is shown by the local wind vanes. R. DEC. WARD.

SPAIN, PORTUGAL

BECKER, JERÓNIMO. **El medio geográfico en la historia de España.** *Bol. Real Soc. Geogr.*, Vol. 58, 1916, Part 3, pp. 257-279. Madrid.

CARANDELL, JUAN. **Las calizas cristalinas del Guadarrama.** 69 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 8.* Madrid, 1914.

—— **Crónica geográfica.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 8-9, pp. 358-363. Real Soc. Geogr., Madrid. [Giving the distribution by provinces of the calculated population of Spain of 20,630,910.]

DARDER PERICÁS, BARTOLOMÉ. **Estratigrafía de la Sierra de Levante de Mallorca (Región de Felanitx).** 41 pp.; map, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 10.* Madrid, 1915.

FURLONG, C. W. **On the crest of the lost Atlantis.** Map, ills. *Harper's Mag.*, No. 801, Vol. 134, 1917, pp. 331-342. [The Azores.]

GIL, P. M. **Memoria anual del cónsul de Chile en Logroño correspondiente al año 1915.** *Bol. de Relaciones Exteriores*, No. 65, 1916, April and May, pp. 33-40. Santiago de Chile.

GÓMEZ DE LLARENA, JOAQUIN. **Bosquejo geográfico-geológico de los Montes de Toledo.** 74 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 15.* Madrid, 1916.

HERNÁNDEZ-PACHECO, EDUARDO. **Las tierras negras del extremo sur de España y sus yacimientos paleolíticos.** Map, ills. *Trabajos del Museo Nacl. de Ciencias Nat.,*

Ser. Geol. No. 13, pp. 3-26. Madrid, 1915. [Abstracted in the December, 1916, *Review*, Vol. 2, pp. 468-469.]

—— **Industrie espagnole, L', et la guerre; Sabadell et l'industrie textile.** Ills. *La Nature*, No. 2222, 1916, April 29, pp. 278-282. [Sabadell is a textile manufacturing town near Barcelona.]

—— **Información geográfico-comercial: La producción española en los mercados extranjeros según el Centro de Información Comercial del Ministerio de Estado.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 1-2, pp. 22-43. Real Soc. Geogr., Madrid.

KNOBLAUCH-COTTENET, MAX. **L'industrie espagnole et la guerre: Les richesses minières et métallurgiques de l'Espagne. Le Creusot-espagnol: Altos Hornos de Vizcaye.** Ills. *La Nature*, No. 2240, 1916, September 2, pp. 150-155.

M——, L. **La popolazione e le risorse economiche del Portogallo.** *L'Esplorazione Commerciale*, Vol. 31, 1916, No. 8, pp. 307-311.

MOYE, M. **Le réseau pluviométrique de l'Espagne orientale.** *Bull. Soc. Languedocienne de Géogr.*, Vol. 38, 1915, No. 4, pp. 260-264.

NAVARRO, L. F. **Monografía geológica del Valle de Lozoya.** 100 pp.; map, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 12.* Madrid, 1915.

—— **Nomenclatura geográfica de España, Reforma de la.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 6-7, pp. 209-244. Real Soc. Geogr., Madrid.

OBERMAIER, HUGO. **Estudio de los glaciares de los Picos de Europa.** 41 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 9.* Madrid, 1914. [For a note on a related paper by this author and the joint authors of the following two papers, see "The Quaternary Snowline in the Iberian Peninsula," *Geogr. Rev.*, Vol. 2, 1916, p. 308.]

OBERMAIER, HUGO, AND JUAN CARANDELL. **Contribución al estudio del glaciarismo cuaternario de la Sierra de Gredos.** 55 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 14.* Madrid, 1916.

OBERMAIER, HUGO, AND JUAN CARANDELL. **Los glaciares cuaternarios de Sierra Nevada.** 87 pp.; map, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 17.* Madrid, 1916.

PRAESENT, HANS. **Bau und Boden der Balearischen Inseln: Beiträge zur Landeskunde der Inselgruppe.** Map, diagrs., ills., bibliogr. *Jahresbericht der Geogr. Gesell. zu Greifswald*, Vol. 13, 1911-12, pp. 21-106. Greifswald, 1913.

QUIRÓS, C. B. DE, AND JUAN CARANDELL. **Guadarrama.** 47 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 11.* Madrid, 1915.

ROUSE, H. E. **Memoria del cónsul de Chile en Bilbao correspondiente al año próximo pasado.** *Bol. de Relaciones Exteriores*, No. 65, 1916, April and May, pp. 40-49. Santiago de Chile.

WAGNER, HERMANN. **Edw. Wrights Seekarte für die Azorenfahrt vom Jahre 1599.** Map. *Petermanns Mitt.*, Vol. 61, 1915, No. 12, pp. 476-479.

ASIA

TURKEY IN ASIA, ARABIA, CAUCASIA, IRAN

GIBBONS, H. A. **The foundation of the Ottoman Empire.** 379 pp.; maps, bibliogr., index. The Century Company, New York, 1916. 9 x 6.

Dr. Gibbons' name has in recent years been associated with the history of the Osmanli Turks. In this volume he presents an account of the rise to power of that branch of the Turkish people which has affected the fate of the western world. Fundamentally the work is a phase of the history of Asia Minor. The emirates, which came to be grouped together under the name of Ottoman Empire, were founded on this Asiatic peninsula. In the fascinating study of the evolution and consolidation of these petty states the author brings no addition to their history, but he has the great advantage of being able to probe somewhat deeper than the average historian into the past life of the Osmanlis because of his residence in their country. His insight therefore guides his reader to a better understanding of the important changes set forth in the book.

These changes are known to every student of Turkish history. Few, however, could give such an excellent description of the military establishment of the early sultans as that presented by Dr. Gibbons. When we think that all the achievement which the Turks can ever boast of as a people rests on their efficiency as fighters, the importance of the topic is readily understood. For the arts of peace or western civilization they cared but little. But, as the author shows, they were practical enough to adopt European methods in tactics and military organization. Anyone familiar with contemporary Turkey can say as much of the Turks today.

The minute research required in the preparation of this work has brought in evidence the extent of the intercourse between the Ottomans and western Europe prior to the fall of Constantinople. This means much at present, when every great European nation is being drawn towards Turkish lands. The events which are now unfolding themselves on Europe's eastern battlefronts provide a climax to activity which can be traced as far back as the first years of the period covered by the author. This historical continuity applies as well to western Asia. Hence to begin the book by stating that a new race appears in history is to overlook the share of the desert-bred Turk in shaping the destiny of Asiatic humanity, which has always exerted its influence on the western world. The Osmanlis had merely advanced farther west than the Mongols or Tatars.

The transliteration of Asiatic names shows once more the great need of a systematic English spelling of eastern geographical and historical names. Dr. Gibbons does not seem to be familiar with the Royal Geographical Society's system.

MOUTRAN, NADRA. **La Syrie de demain.** viii and 462 pp.; maps, diagr. Plon-Nourrit et Cie., Paris, 1916. 6 fr. 8 x 5.

Syria since the days of Phenician navigators and up to the Turkish conquest enjoyed an uninterrupted intercourse of trade with southern Europe. Out of these historical beginnings arose the problems discussed in this book. The author devotes considerable space to the natural resources of the country and shows that their development during the past half-century received its strongest impetus from French sources. As he was born and bred in the midst of Syria's motley population, his descriptions of the inhabitants have all the flavor of intimate knowledge. Syria, like Mesopotamia, is one of western Asia's corridors and a great meeting-land of men of the Alpine and Mediterranean races, that is, of highlanders and lowlanders. The Syrians, described under various names, are products of this mingling and consist of peoples well known for their lack of union.

In treating of Syria's status after the war, the author advocates the creation of a unit which will extend from the Gulf of Alexandretta to the Egyptian boundary. Like all Syrians he is in favor of strengthening the ties that bind France and his native land. To those who would see Palestine incorporated with Egypt he shows that, geographically, Palestine is the natural termination of the Syrian regional unit, and that the stretch of desert between Gaza and the Nile has been an obstacle to intercourse since early historical times.

CHINA

BISSOLI, LUIGI. **Notizie di geografia commerciale sulla Cina.** *L'Esplorazione Commerc.*, Vol. 31, 1916, No. 6, pp. 225-235.

DE MOIDREY, J. **Meteorological observations at Lu-Kia-Pang, China, for 1914.** *Symons's Meteorol. Mag.*, No. 603, Vol. 51, 1916, April, pp. 33-36; No. 604, May, pp. 53-55.

FISHER, W. K. **The oldest place of worship in the world.** Ills. *Scientific Monthly*, Vol. 2, 1916, No. 6, pp. 521-535. [Tai Shan, in Shantung province, China.]

MEAD, D. W. **Floods and famine in China.** *Journ. of Geogr.*, Vol. 14, 1916, No. 7, pp. 261-264. ["Reprinted from the *Wisconsin Alumni Magazine*, June, 1915."]

—— **Note sur les travaux topographiques de la mission Voisins-Segalen-Lartigue dans la Chine occidentale, 1914.** Map. *La Géogr.*, Vol. 30, 1914-15, No. 4, pp. 308-311. Paris.

ROXBY, P. M. **Wu-Han: The heart of China.** Maps, ills. *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 6, pp. 266-279.

TING, V. K. **The coal resources of China.** Map, ills. *Far Eastern Rev.*, Vol. 13, 1916, No. 1, pp. 1-4. Shanghai.

VAN DER VEEN, H. **The South Grand Canal conservancy scheme.** Ills. *Far Eastern Rev.*, Vol. 12, 1916, No. 9, pp. 333-338.

—— ***China—East Coast: The Brothers to Ockseu Island, including the west coast of Formosa from Onkan bank to Kukan road.*** 1:300,000. *U. S. Hydrogr. Office Chart No. 3177.* Washington, D. C., 1916.

—— ***China—Southeast Coast: Kwangchow Bay and River Matshe.*** 1:40,000. *U. S. Hydrogr. Office Chart No. 3169.* Washington, D. C., 1916.

—— ***Hainan Strait.*** 1:150,000. *U. S. Hydrogr. Office Chart No. 3164.* Washington, D. C., 1916.

ROUX, FRANÇOIS. ***Se-Tch'ouan occidental.*** 1 in. to 12 mi. (1:760,320). Inset: Province du Se-Tch'ouan. Mission Catholique, Shanghai, 1910.

—— ***Tchen Tou, Plaine de, près Shanghai.*** 1:200,000. Mission Catholique, Shanghai, [1910].

—— ***Tonkin Gulf.*** 1:700,000. *U. S. Hydrogr. Office Chart No. 3153.* Washington, D. C., 1916.

—— ***Tonkin Gulf, Approaches to Haifong.*** 1:72,000. *U. S. Hydrogr. Office Chart No. 3161.* Washington, D. C., 1916.

—— ***Yang-Tse-Kiang, Bassin inférieur du.*** 1:1,000,000. Service Géogr. de l'Armée, Paris, [1913].

—— ***Yangtze River: Shanghai to Nanking.*** 1:150,000. *U. S. Hydrogr. Office Chart No. 3182.* Washington, D. C., 1916.

—— ***Yangtze River: Tunglin to Hankow.*** 1:73,000. *U. S. Hydrogr. Office Chart No. 3185.* Washington, D. C., 1916.

INDIA

BAKER, H. D., AND OTHERS. **British India, with notes on Ceylon, Afghanistan, and Tibet.** 638 pp.; map, diagrs., ills. *Special Consular Rept. No. 72.* Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, 1915. 9½ x 6.

The material for this report was gathered by Consul Henry D. Baker and it presents comprehensive facts concerning our markets in India. The report has some clear, explanatory accounts of trade and industrial conditions of value to the commercial traveler seeking new fields. The importance of geographical influences in trade relations is frequently emphasized, as in the following extracts relating to the monsoons:

"The (rainy) monsoon is to India what the Nile is to Egypt in the general prosperity of the country. The monsoon has such an important effect on the general trade that there is a reluctance to enter into business engagements until it is known whether the monsoon is a success or a failure. Commercial travelers then will find their customers in a more definite frame of mind regarding the purchase of goods at the end of the monsoon in September and October. The alternate excess of humidity and then dryness, together with the great heat of moist districts, requires considerable consideration as regarding packing of goods and the materials employed in manufacturing. Iron and steel rust rapidly under these conditions; leather goods become covered with mold; furniture warps and most provisions have to be sealed in tins."

The excessive heat of India requires air-cooling devices. The ancient punkah-wallah has been replaced to a slight extent by electric fans, Calcutta alone having 40,000 fans in use. There is an increasing market for the American makes. Waterpower development has made electricity cheap in some regions, for instance in Simla, the summer capital of India, it is cheaper than kerosene. The electric angethi is replacing the charcoal heater. American electrical equipment has been utilized in many of the hydro-electric plants.

Some of the states of India are under the control of native princes whose authority is absolute. The State of Hyderabad is about the area of New York and Massachusetts, with a population of thirteen millions. His Highness the Nezam of Hyderabad has a personal income of over two million dollars and his palaces have all of the most modern devices for convenience and comfort. About four hundred motor cars are owned by His Highness for the use of his guests and the ladies of the royal zenana. The Maharaja of Mysore uses electric lights of American manufacture, telephones made in Chicago, motor cars from Cleveland and a large pipe organ from Salem, Ohio.

The report is valuable to export houses, and its clear statements regarding trade conditions should be followed by the commercial traveler who seeks to develop business in India. The map accompanying the report, one of the regular stock of wax-engraved maps sold by a commercial firm, falls far short of the standards we have become accustomed to expect in a government document. W. M. GREGORY.

The preceding review may be supplemented by a word on some striking effects of the monsoon in India on commercial conditions in New York. The cocoa nut is an important product of southern India: it is indeed the chief commercial crop of the Malabar coast. The annual harvest is estimated at some 1,000 million nuts and the copra of Cochin commands the highest price in the world market. Export of the product is largely regulated by climatic conditions. During July and August the summer (southwest) monsoon attains its maximum force and raises high seas along the peninsula coasts. Similarly the winter monsoon, comparatively light in the head of the Bay of Bengal, blows strongly along the Coromandel coast up to January (H. F. Blanford: The Climates and Weather of India, Ceylon, and Burmah, London, 1889). At these two seasons when the always heavy surf is augmented shipping is greatly delayed. Cargoes dependent upon lighterage are deferred until the subsidence of the winds. Thus cocoanut oil and copra accumulate in quantities and the supply often runs short in the United States. Some traders therefore arrange for increased shipments just before the heavy winds begin and on the last boats to leave the exposed coasts. The result is that they control the New York market, which means, in the case of these products, they control the market throughout the country.

—— **Annual reports of parties and officers, 1913-14.** x and 180 pp.; maps, diagrs., ills., bibliogr. *Records of Survey of India*, Vol. 7. Calcutta, 1916.

—— **Annual reports of parties and officers, 1914-15.** 176 and ix pp.; maps, ills. *Records of Survey of India*, Vol. 9. Calcutta, 1916.

BARNARD, A. S. **Glimpses of Ceylon.** Ills. *Journ. Manchester Geogr. Soc.*, Vol. 31, 1915, Parts I-IV, pp. 36-51. [An address delivered to the Manchester Geographical Society on November 23rd, 1915.]

BURRARD, SIDNEY. **The plains of northern India, and their relationship to the Himalaya Mountains.** *Records of Survey of India*, 1914-15. Vol. 9, pp. 149-163. Calcutta, 1916.

HAYDEN, H. H. **The mineral production of India during 1915.** *Records of Geol. Survey of India*, Vol. 47, 1916, Part III, pp. 144-195. Calcutta.

HUMAN GEOGRAPHY

ANTHROPOLOGY AND ETHNOLOGY

BERRY, E. W. **The environment of the ape man.** Maps, ill. *Scientific Monthly* Vol. 3, 1916, No. 2, pp. 161-169.

The ape man referred to by Professor Berry is the Pithecanthropus, or Trinil man of Java, discovered in 1891. The scanty remains of this man have been the theme of endless controversy and literature, but the final verdict is very much in accordance with the views of the discoverer, Dubois, although the period of their deposition is now considered early Pleistocene and not, as first believed by him, Pliocene.

The paper deals with the plant life associated with the skeletal remains and the accompanying fauna, both vertebrate and invertebrate. The author assigns the date of the beds in which the remains were found to Günz (first) or Mindel (second) glaciation (in Europe), following Penck and Osborn in this correlation, but doubting the antiquity (500,000 years) ascribed by them to this period. Both the flora and the fauna are clearly of northwestern origin, that is from India and Indo-China, and Pithecanthropus very probably represents an outlying member of the group of the most primitive men scarcely evolved from the ancestral anthropoid stem—in fact, an intermediate type. As the author states, there is no reason to assume that he stood in direct ancestral relation to the Neanderthal or the Neanderthaloid Heidelberg man.

Man most likely became man in Central Asia during the warm and moist Pliocene, and his evolution there was greatly accelerated by the advancing cold of the oncoming Glacial Period. This cold naturally destroyed the forest and with it the food supply, forcing the proto-human ape not only to abandon his refuge in the trees but to change his habits and become definitely carnivorous. Man from that early time, the beginning of the Pleistocene down to the opening of the Neolithic, about 12,000 years ago, remained purely carnivorous, and some living tribes, such as the Eskimos, still remain so. With this change from a partly arboreal habitat and frugivorous diet to life on the ground as a predatory meat-eating animal, came the association in hunting packs or groups and the need of weapons and tools. Along with the newly acquired freedom from locomo-

tion of his hands, the opposable thumb developed, and the ape man started on his evolutionary road to full humanity. This road led to a large extent through the extermination of the larger mammals, at first his dangerous enemies and later his legitimate prey.

The instincts of hunting and killing, which in the early days of man's supremacy destroyed many species of rival mammals, were finally turned against rival tribes and remain well developed to this day. At each stage of this early evolution, which it is safe to assume was in Asia, the most advanced group spread widely and killed off or absorbed its less progressive neighbors, except such as had found an isolated refuge. In outlying countries or islands these less developed types may have lingered long unchanged, and Pithecanthropus may have been a representative of such antiquated remnants surviving in Java, while in the ancestral broodland in Central Asia the rigorous selection due to the changing climate and advancing glaciers compelled an accelerated evolution in the original stock from which the forebears of Pithecanthropus sprang. In short, the finding of Pithecanthropus in a remote corner of the Holarctic region does not preclude the possibility of the contemporary existence of more developed types in the geographical center of radiation of the human family.

Professor Berry's paper is an illuminating and fascinating study of the life surroundings of the earliest ape man of which we have as yet definite knowledge. It is this kind of intensive study that is laying sure foundations for our knowledge of the surroundings of the Men of the Dawn.

MADISON GRANT.

EDUCATIONAL GEOGRAPHY

DRYER, C. R. **Elementary economic geography.** 415 pp.; maps, diagrs., ills., index. American Book Co., New York, Cincinnati, and Chicago, 1916. $1.28. 8 x 5½.

Geography can be taught effectually only as essential features are emphasized and as less important facts are disregarded. This work recognizes this principle to a greater extent, perhaps, than any other textbook of geography. It does not attempt to cover the whole world, nor does it attempt to treat all the minor industries of the United States, with which country it primarily deals.

The first of the two parts into which the book is divided has for its purpose the teaching of the fundamentals of economic geography. This is done (1) by a series of descriptive illustrations showing the dependence of primitive peoples upon their environment, (2) by a suggested study of the economies of the home region, and (3) by a brief statement of the principles underlying the organization of complex economic societies.

The second part of the book deals with the economic geography of the United States. For the purpose of this study the United States is divided into five industrial or economic regions, which necessarily bear a close relation to the natural regions of the country. Each economic region is treated from the standpoint of the chief occupations of that region with the view of showing how the people obtain a living.

Much may be said in commendation of the book. The division of the United States is sufficiently simple to be readily comprehended and appreciated by pupils of the grades, for which the book is intended. The division on the basis of great industries will doubtless appeal to pupils more readily than division into natural regions, or the arbitrary grouping of states which is found in most books. Quite as important as the manner of division of the country is the strong association made between each region and its chief activities. For instance, the Eastern States stand first of all for manufacturing, the Southern States for agriculture, and so on. This treatment suggests one of the best solutions of the problem of minimum essentials. Even more striking than the statement and classification of facts is the emphasis laid upon principles of geography. Principles are frequently stated and are constantly suggested. Indeed, few facts are given which do not have some bearing upon significant generalizations. While the book deals essentially with the United States, brief reference is made, in the treatment of every region and in the discussion of almost every industry, to conditions in other parts of the world. Thus, to the pupil, the United States is not an isolated region. In comparison with the rest of the world its similarities, differences, and relations are constantly shown.

With all its good qualities the book must be used with some caution. Not a few terms and expressions are beyond the comprehension of pupils of junior high school age. Moreover, principles and generalizations are sometimes stated without sufficient illustration to make them understood by the average pupil. These features of the book, however, should present no great difficulty to the experienced teacher who constantly keeps in touch with the attainments and capabilities of her pupils.

LEONARD O. PACKARD.